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HOUSING CHOICES
for Canadians with Disabilities

92-04503/

HOUSING CHOICES

for Canadians with Disabilities

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Cette publication est aussi disponible en français sous le titre *Choix de logements au Canada pour les personnes handicapées* (LNH 6620).

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CANADIAN CATALOGUING IN PUBLICATION DATA

Main entry under title:

Housing choices for Canadians with disabilities

Issued also in French under title: Choix de
logements au Canada pour les personnes handicapées.
Includes bibliographical references.
ISBN 0-662-19581-7
DSS cat. no. NH15-74/1992E

1. Dwellings — Canada — Access for the physically handicapped. 2. Architecture and the handicapped — Canada. 3. Physically handicapped — Housing — Canada. I. Canada Mortgage and Housing Corporation.

NA2545.P5H68 1992 728'.042'0971 C92-099662-0

© 1992, Canada Mortgage and Housing Corporation

ISBN 0-662-19581-7
Cat. No. NH15-74/1992E

Printed in Canada
Produced for CMHC's Research Division by the
Public Affairs Centre, CMHC

Acknowledgements

This publication results from a co-operative initiative between the Ontario Office for Disability Issues and Canada Mortgage and Housing Corporation.

Without the considerable assistance provided by countless individuals and organizations in Canada and around the world, this publication would not have been possible. The information received from the over 250 contributors, the many worthwhile comments provided by the reviewers, and the statistical data provided by Statistics Canada have enabled Canada Mortgage and Housing Corporation to produce this wide-ranging report on innovative housing, support services and technologies designed to enhance the independence and lifestyles of persons with disabilities.

Luis Rodriguez of the Research Division of CMHC prepared this publication.

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Introduction

Like all Canadians, persons with disabilities — the senior citizen who relies on a walker to get around, the young person using a wheelchair, the blind woman with a seeing-eye dog, the child with multiple sclerosis — come from diverse backgrounds, are interested in different things and have varying levels of health and fitness. Their needs, preferences, attitudes, types and degrees of disabilities, and circumstances are as individual as they are.

Persons with disabilities are expressing an overwhelming desire to control their own lives and live as independently as possible. They want to contribute to society as full working citizens and, not surprisingly, they want the freedom to make their own lifestyle choices: how they are going to live and where they are going to live.

It can, therefore, be expected that persons with disabilities will increasingly demand a greater choice of housing options. In particular, they are likely to seek options that will enable them to maintain or regain independent lifestyles. Current trends indicate that more and more are electing not to live out their lives in institutional-care facilities, preferring instead to be a part of the community at large.

But to live in the communities and neighbourhoods of their choosing, persons with disabilities need to have available to them suitable housing, adequate support services, accessible transportation networks, and barrier-free places of work and public spaces.

To respond to these demands, governments and the housing industry need to encourage diverse approaches to housing; to promote innovation in tackling specific accommodation problems; and to be sensitive to the housing preferences of persons with disabilities. In order to respond intelligently and with sensitivity, however, those involved in the housing of Canadians need to be well informed and prepared to take necessary action.

CMHC is now working with other government agencies, the non-profit and private sectors, and consumers to gain a better understanding of the housing needs of persons with disabilities, to explore promising new housing options and to identify the actions that may be necessary to make the kinds of housing options touched on in this publication widely available.

This Publication

The main purpose of this publication is to increase public awareness of the range and types of accommodation options that are, or could be, available to Canadians with disabilities. Although the emphasis is primarily on options for people with physical disabilities, a number of options for people with other types of disabilities have also been included. Many are innovative and transferable. It is hoped that the information in this publication, together with additional information that will flow from future initiatives, will help people arrive at their own conclusions about what is best for them.

An attempt has been made to bring together in this publication a good cross-section of the types of housing services and technologies that have been developed around the world and in Canada. However, many other examples not illustrated here may be equally innovative. Readers should also appreciate that it was not possible to describe all the features of the examples that are included in this publication. For anyone seeking additional information on these examples, the names of organizations and individuals who contributed information — in many cases, the project architect/designer — are in the "Credits" section at the end of the publication.

Many of the options discussed in this publication are not yet widely available in Canada; in some cases, regulatory change may be required before an option can be put into place. By exposing the many ideas that have been, or are being, tried, perhaps this publication can also serve to stimulate change or enhance interest, if only by encouraging a discussion of the options that could be transferred to the Canadian scene and by facilitating co-operation between regulatory agencies and industry, who, by working together, can help to make them available.

PART ONE

A Backgrounder to Housing Choices for Canadians with Disabilities

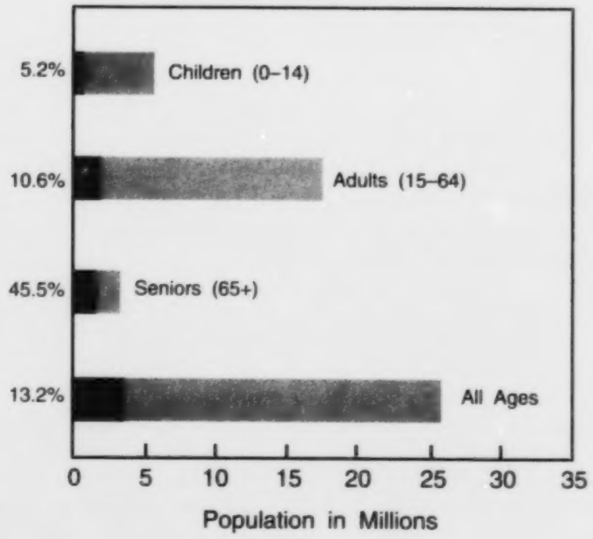
CHAPTER 1

Understanding the Needs

The Population

According to the 1986 Health and Activity Limitation Survey by Statistics Canada,[1] a significant proportion of the Canadian population — more than 13 percent, or 3 300 000 Canadians — has some level of activity limitation (see **Table 1**). The results of this survey also show that the likelihood of having disabilities increases with age. According to the survey, 5.2 percent, or 277 400 children 14 years and under; 10.6 percent, or 1 817 400 adults between 15 and 64 years; and 45.5 percent, or 1 221 900 seniors aged 65 and over had some difficulty in carrying out one or more of the Activities of Daily Living (ADL).* With the aging of the population and particularly with the rapid growth of the 75-years-and-over age group, it is likely that the number of Canadians with disabilities will increase substantially over the next 40 years.

Table 1
Percentage of Canadians with Disabilities, by Age Group



Source: 1986–1987 Health and Activity Limitation Survey, Statistics Canada

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* The Activities of Daily Living (ADL) are a number of activities that people undertake daily or regularly, such as getting in and out of bed, or going up or down a flight of stairs, and that are essential to their physical independence.

Living Arrangements and Accommodation

In 1986, the vast majority of Canadians with disabilities (93 percent) lived in private households (see **Table 2**), while the remaining 7 percent lived in health-related institutions.

However, living arrangements varied significantly by age group, with 16 percent of seniors living in institutions, compared to fewer than 3 percent of adults aged 15 to 64 and 1 percent of children. Of all Canadians with disabilities living in institutions, 79 percent were seniors, 20 percent were adults aged 15 to 64 and 1 percent were children.[2]

Most Canadians with disabilities living in private households are living in a family setting. In 1986, for example, 78 percent of those aged 15 to 64 were living with their families as husbands, wives, single parents, sons or daughters. Another 9 percent in the same age group were living with other family members (brothers, sisters, aunts and uncles) or with non-relatives. However, a relatively large proportion of persons with disabilities living in private households, 12 percent of those aged 15 to 64 and 30 percent of those aged 65 and over, were living alone.[3]

According to the 1986 Health and Activity Limitation Survey, of those persons with disabilities aged 15 to 64 who live in private households, 65 percent own their homes and approximately 35 percent are tenants. Of the non-disabled population in the same age group, 70 percent own their homes and about 30 percent are tenants.

Table 2
Living Arrangements of *Canadians with Disabilities* by Age Group

	Percentage Living in Private Households	Percentage Living in Institutions	Percentage of *Canadians with Disabilities*
Children, aged 0 to 14	99	1	8.4
Adults, aged 15 to 64	97	3	54.8
Seniors, 65 and over	84	16	36.8
Canadians with disabilities, all ages	93	7	100.0

Source: The 1986–87 Health and Activity Limitation Survey, Statistics Canada

Definitions:

A Private Household refers to a person or group of persons (other than foreign residents) who occupy a private dwelling and do not have a usual place of residence elsewhere in Canada. The number of private households equals the number of occupied private dwellings.

Institutions (health-related institutions) refers to orphanages and children's homes, special care homes, and institutions for the elderly and chronically ill, general hospitals, psychiatric institutions, and treatment centres and institutions for the physically handicapped.

Disabilities

There are many types of disability. The percentage of those Canadians with disabilities who experience various types of disability by living arrangements and age group is shown in **Table 3**. The disabilities are classified under seven types described under the column "Types of Disability." An explanation of each is provided in the table.

In 1986, many Canadians reported having more than one type of disability; this is reflected in the percentages shown in **Table 3**. Of all Canadians with disabilities, 64 percent reported having more than one type of disability, with 31 percent reporting two types and 33 percent reporting three or more types. Multiple disabilities are more common among seniors. In 1986, 75 percent of Canadians with disabilities aged 65 and over reported having more than one type of disability, compared to 56 percent for those aged 15 to 64.[3] The types of disability most often reported in pairs relate to mobility and agility. Speaking disabilities are often reported in combination with other disabilities, while hearing disabilities are most frequently found alone.[4]

The most common types of disability are those related to mobility and agility. Among people with disabilities, seniors have much higher incidences of disabilities associated with mobility, agility, seeing and hearing, compared to the younger age groups. For example, **Table 3** indicates that among Canadians with disabilities living in private households, 43.2 percent of those aged 65 and over reported having hearing disabilities, compared to 23.6 percent of those aged 15 to 64.

The last two rows of **Table 3** show the percentage of persons with disabilities using wheelchairs and other mobility aids. Of those living in private households, 3.2 percent of children and 3.3 percent of adults use a wheelchair, while 2 percent of children and 12.6 percent of adults use other mobility aids.

Not all persons with disabilities experience the same degree of limitation. To provide a basis for a better understanding of the range of limitations, Statistics Canada has developed a scale for estimating the severity of a disability. This scale is based on a series of screening questions relating to over 20 activities of daily living. Responses to these questions from the 1986 Health and Activity Limitation Survey were recorded, and each loss of function was assigned one or two points, depending on whether the loss was partial or total. The totals from this point system were then classified into three groups: mild (1 to 4 points); moderate (5 to 10 points); and severe (11 or more points).[4] The results indicated that, in 1986, of Canadians with disabilities, 23 percent were severely disabled, 32 percent were moderately disabled and 45 percent were mildly disabled. Within the age groups, 35 percent of seniors had severe disabilities, compared to 16 percent of those aged 15 to 64 and 9 percent of children.[3]

Children with learning disabilities and living in private households make up the largest single group of children with disabilities. In 1986, of all children with disabilities, 26 percent had a learning disability, with 9 percent also reported to have a mental handicap, such as developmental delay; 10 percent had a seeing disability; 17 percent had a hearing disability; and 17 percent of those aged 5 to 14 years had a speaking disability.[5]

Table 3
Types of Disabilities of *Canadians with Disabilities* by Living Arrangement and Age Group

Types of Disability	Percentage by Living Arrangement and Age Group							
	Children (0–14)		Adults (15 and over)					
			Adults (15–64)		Seniors (65 & over)		Total (15 and over)	
	H	I	H	I	H	I	H	I
Mobility: Limited in ability to walk, move from room to room, carry an object for 10 metres, or stand for long periods	CNA	CNA	59.3	57.1	73.3	88.9	64.4	82.4
Agility: Limited in ability to bend, dress or undress oneself, get in and out of bed, cut toenails, use fingers to grasp or handle objects, reach, or cut own food	CNA	CNA	51.9	73.1	60.5	92.6	55.1	88.7
Seeing: Limited in ability to read ordinary newsprint or to see someone from 4 metres, even when wearing glasses	10.1	N/A	11.6	28.3	23.5	47.5	16.0	43.6
Hearing: Limited in ability to hear what is being said in conversation with one other person or two or more persons, even when wearing a hearing aid	17.4	N/A	23.6	23.5	43.2	51.9	30.8	46.1
Speaking: Limited in ability to speak and be understood	* 17.3	N/A	6.1	50.7	5.2	29.7	5.8	34.0
Other: Limited because of a learning disability or emotional or psychiatric disability, or because of developmental delay	CNA	CNA	28.0	85.4	26.0	70.9	27.3	73.9
Unknown: (nature of disability not specified)	CNA	CNA	8.4	.4	2.5	.3	6.2	.3
Percentage using wheelchairs [1]	3.2	N/A	2.6	26.6	4.6	38.3	3.3	35.9
Percentage using canes, crutches, walkers, or other mobilty aids [1]	2.0	N/A	8.0	12.6	20.3	36.3	12.6	31.5

H = In Private Households
I = In Health-Related Institutions

N/A = Not Available
* = Includes children aged 5–14 only

CNA = Concept not Applicable

[1] People with disabilities may indicate that they use a wheelchair in addition to other mobility aids; in such cases, they are included in both categories

NOTE: Column percentages do not add to 100% because Canadians with disabilities may report more than one type of disability

Source: The 1986–87 Health and Activity Limitation Survey, Statistics Canada

Income and Affordability

Canadians with disabilities generally have lower incomes than other Canadians. In 1985, men with disabilities aged 15 and over had a median total income of $13,000; this compared to $20,900 for men without disabilities. In the same age group, women with disabilities had a median total income of $8,200 compared to $10,000 for women without disabilities.[3]

In the same year, the average employment income of Canadians with disabilities aged 15 to 64 years and living in private households was $16,875, compared to $18,765 for other Canadians in the same age group. The average employment income of people with disabilities aged 15 to 24 was $6,185, compared to $7,440 for others in the same age group. In the 55 to 64 age group, the average employment income for people with disabilities was $17,325, compared to $22,030 for others in the same age group.[6]

In 1985, 52 percent of persons with disabilities 65 years old and over only received total incomes between $5,000 and $10,000, compared with 41 percent of other Canadians in the same age group. At the other end of the income scale, 7 percent of Canadians with disabilities aged 65 and over had incomes greater than $25,000, compared with 13 percent of those without disabilities.[3]

Barriers to Independence

Over the last 20 years, the private, non-profit and public sectors in Canada have implemented a range of initiatives designed to address the needs of persons with disabilities. As a result, more and more Canadians with disabilities now enjoy a wider range of accommodation, support service and transportation options.

Progress has also been made in making the environment more barrier-free and usable by persons with disabilities. However, many barriers still exist, which hamper the ability of many Canadians with disabilities to live independently. In 1986, for example, 8 percent of Canadians with disabilities aged 15 and over indicated that they were unable to leave their homes because of health problems or their disability, while another 10 percent had trouble using local transportation services. A significant number of people with disabilities also encounter barriers that affect their entry or exit from their homes or their ability to move about inside: over 2 percent of those aged 15 and over said they needed, but did not have, special features such as access ramps or street-level entrances; another 3 percent indicated that they needed, but did not have, special features such as handrails inside their homes.[2]

Barriers in homes are as much an impediment for children as they are for adults. The 1986 survey results show that 4 percent of those between the ages of 5 and 14 required special features to enter or leave their residence, but half of this group did not have these features. As well, 3 percent of the children in this age group required other specialized features, but these were not available to more than one third.[5]

Difficult access to bathroom facilities is a problem commonly faced by children with disabilities. In 1986, 5 percent of those aged 5 to 14 said they had difficulty using the bathtub, and 4 percent had difficulty using the toilet and basin. Modifications to these facilities had been made for only about one third of these children.[5]

CMHC has been actively exploring and promoting ways to increase the range of housing options for seniors, placing particular emphasis on those that can enable them to live independently. The private and non-profit housing sectors have shown increasing interest in responding to seniors' housing needs. However, younger people with disabilities have limited choices in where they can live because few options have been initiated by the private sector. To increase the range of choices within a community, it is important to find ways of encouraging the private sector to become more involved in meeting the housing needs of persons with disabilities in all age groups. ▲

References

[1] The 1986 Health and Activity Limitation Survey, Statistics Canada, Ottawa, 1986.

[2] *A Socio-Demographic Profile of Canadians Experiencing Health or Activity Limitations*, a report prepared for CMHC by Hussein Rostum and Eliane Thonney, TEEGA Research Consultants Inc, March 1991.

[3] From "Profile of Canadians with Disabilities," by Katherine Nessner, *Canadian Social Trends*, Statistics Canada, No. 18, Autumn 1990, Catalogue 11-008E.

[4] *An Economic Profile of Persons with Disabilities in Canada*, by David P. Ross and E. Richard Shillington for the Department of the Secretary of State of Canada, Ottawa, 1990.

[5] From "Children with Disabilities," by Katherine Nessner, *Canadian Social Trends*, Statistics Canada, Winter 1990.

[6] Table 14: Average Employment Income of Disabled and Non-Disabled Adults Aged 15 to 64 Residing in Households by Sex and Age Groups, Canada, 1985, Statistics Canada, Catalogue #98-126.

Housing Design Concepts

Governments, the housing industry, designers and consumers around the world have become increasingly aware in recent years of the need to promote and make available housing that is accessible, barrier-free and safely usable by persons with disabilities. They are also finding that there is a need to provide a range of cost-effective housing options to address a variety of individual needs and preferences. Within this context, many housing design concepts have emerged. Some of the most important of these concepts are described in this chapter; they are also reflected in the design of many of the housing options featured elsewhere in this publication.

Accessible Housing

allows people with disabilities to get to, enter and exit a home. At least some of the rooms and facilities are convenient for visits or short-term use. This type of housing is designed to meet the accessibility needs of users with various disabilities, including people who use a wheelchair, people who have difficulty walking, bending or standing for long periods, and people with hearing or seeing disabilities. With adaptations to meet specific needs, accessible housing can provide convenient, permanent homes for people with particular disabilities.

Adaptable Housing

is accessible housing that is also designed and constructed to be easily adaptable to meet the different or changing functional needs of the occupants, including persons with particular disabilities. The spatial requirements of a person using a wheelchair is one of the basic design considerations for adaptable housing.

Adapted Housing

is housing that has already been adapted to meet the specific needs of a person, or persons, with a particular disability, or disabilities.

Barrier Free Housing

allows people with disabilities to get to, enter and exit a home, and use all of the rooms and facilities. It is designed to accommodate the specific needs of users with a particular disability, or a range of disabilities, including people who depend on a wheelchair for their mobility, persons having difficulty walking, bending, or standing for long periods, and people with hearing, seeing or speaking disabilities.

Housing for Environmentally Hypersensitive People

is designed, built and operated to provide a healthy and comfortable environment for its occupants. It uses a number of techniques and approaches aimed at minimizing the sources of pollutants from both inside and outside the building, in combination with effective ventilation to remove or dilute any pollutants that do occur.

Life Care Housing,

a design concept recently introduced in Japan, is based on the principle that homes should be designed to enable occupants, including seniors and persons with disabilities, to live in comfort for years to come. The practical application of this concept will result in otherwise ordinary homes having built-in design provisions to make everyday living easier, more enjoyable and convenient for everyone, at any time during their lives. (Note: This concept is similar to the concept of "Universal Design" described later in this chapter.)

Lifespan Housing

is a design concept introduced in Norway in 1981 that builds on the principles of adaptable housing. The main objective is to design and develop homes with all essential rooms on the entrance floor, so that normal daily living does not require climbing stairs. The essential rooms include the living and dining rooms, the kitchen, at least one bedroom, and a bathroom containing a wash basin, toilet and either a bathtub that can be readily converted into a shower or a shower that can be readily converted into a bathtub. The entrance floor is accessible from the outside, and there are no steps or thresholds. Floor spaces and door widths allow the use of walking aids and wheelchairs.

Mobility Housing
is designed to address the needs of people who have difficulty walking. These people may use a wheelchair, but they can also stand and walk a few steps, although often only with assistance. Mobility housing allows these people to get to, enter and exit a home, and use all of the rooms and facilities. It is not, however, entirely barrier-free for people who totally depend on a wheelchair for mobility. This type of housing also has the potential to meet the needs of people with other types of physical disability, including hearing and seeing disabilities.

Safe Housing,
an innovative design concept that originated in New Zealand, combines the principles of barrier-free design with passive fire safety measures and basic security provisions. The result is an intrinsically safe and universally accessible home environment that promotes personal well-being and lifelong physical independence.

Universal Design
aims to accommodate the functional needs of everyone; children, adults and seniors, with or without disabilities. It is based on the premise that a well-designed environment addressing the needs of people with disabilities can also be a better environment for everyone. Widespread adoption of this approach would provide people with disabilities with increased opportunities to live independently in homes that look no different from any others.

Wheelchair Housing
is barrier-free housing for people who depend on wheelchairs for mobility. It is designed so that they can perform the activities of daily living as independently as possible. Every design detail reflects the particular needs of a person using a wheelchair, including appropriate locations and heights for light switches, electrical outlets and windows; complete accessibility to facilities, equipment and furniture; and sufficient space for maneuvering a wheelchair in all rooms and facilities. ▲

PART TWO

Enhancing Independence Through Housing

CHAPTER 3

Adapting Existing Housing

For many people with disabilities, living independently in an older home is the preferred housing option. Unfortunately, because much of the housing stock has not been designed to accommodate their needs, even basic activities — accessing the home, moving from one floor to another, preparing meals, using the bathroom and operating kitchen appliances — are performed with great difficulty.

Much of the existing housing stock can, however, be adapted to enable people with disabilities to live independently, and with dignity, in their own communities. Not only have people themselves instigated the modification of their homes, but governments and community-based organizations around the world have also introduced home adaptation initiatives that promote choice and support independence. A number of individual and community-based initiatives are described in this section.

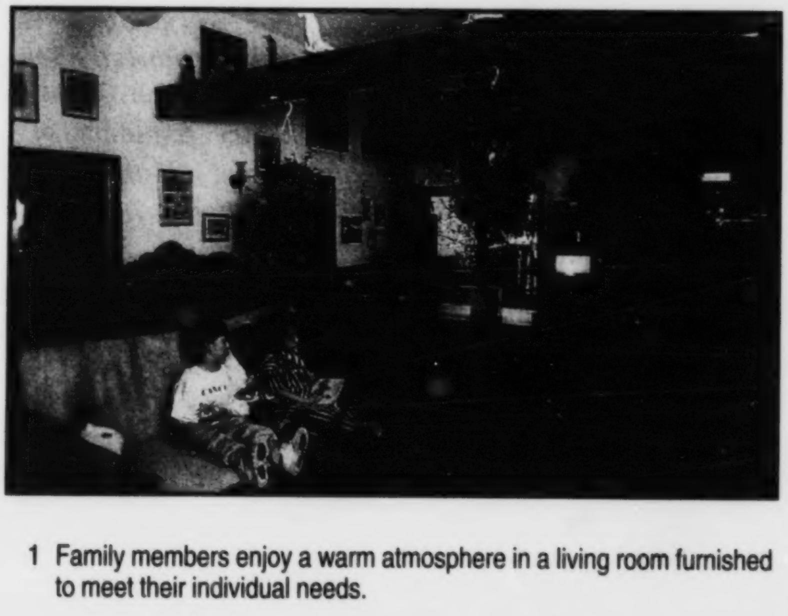
Individual Homes

Many people with disabilities prefer to live in individual homes in established neighbourhoods. The following experiences highlight the innovative ways in which existing housing can be adapted to meet a variety of individual needs and preferences.

The Osborne Residence

After countless deliberations on the proper house environment — and exhaustive investigations into the pros and cons of new construction versus renovation, the Osbornes, who live near Brampton, Ontario, finally opted for extensive renovations to their existing house. While the house is not a perfect solution because of compromises that had to be made, it does accommodate the varying needs of 16 adopted children (and has sheltered as many as 20). The residence represents a particular combination of improvements and additions to an existing house in a rural area for a unique family with a myriad of physical challenges that range from blindness to complete wheelchair-dependency.

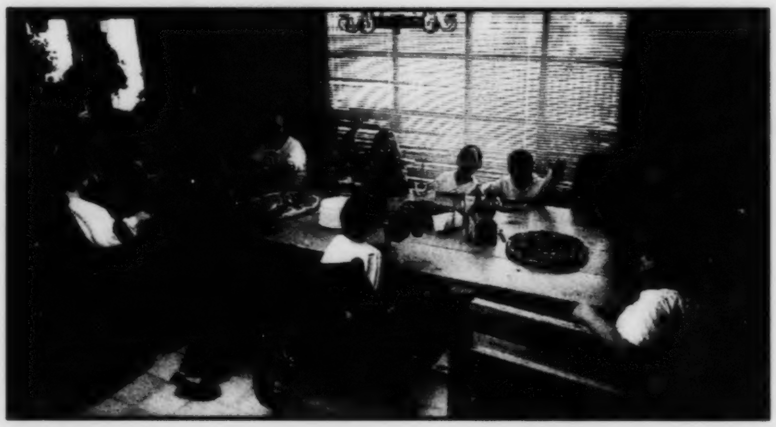
As the adopted children have varying types and degrees of physical challenges, it was vitally important to the Osbornes that their home accommodate a cross-section of individual



1 Family members enjoy a warm atmosphere in a living room furnished to meet their individual needs.

needs. The renovation was carried out in three phases, and every household member was consulted so that specific needs and preferences could be accommodated. While the major objective of the renovation was to make the home as barrier-free as possible, great care was also taken to find ways of enhancing the residential flavour of the home: spray painting the urinal so that its colour would complement the other bathroom fixtures; laying low-pile carpet in the living areas; putting in skylights rather than fluorescent lights. The result is a home environment replete with paintings, individualized custom-made beds, screened gazebo, play area and pool. Connecting paved walkways link various areas of the property, and the patio and play area are readily accessible from the deck, which is on the same level as the main floor.

The two elevators, panic buttons in strategic locations, lever-type hardware on doors, hallways that allow wheelchair users to move freely into the doorway of any room, doorways wide enough to allow a wheelchair to pass through, specially designed escape windows and sliding doors do not detract from the personal, homelike atmosphere. Recent changes to the residence include replacing the concrete steps at the front entrance with wood steps and making the access between the living and dining rooms more direct. ▲



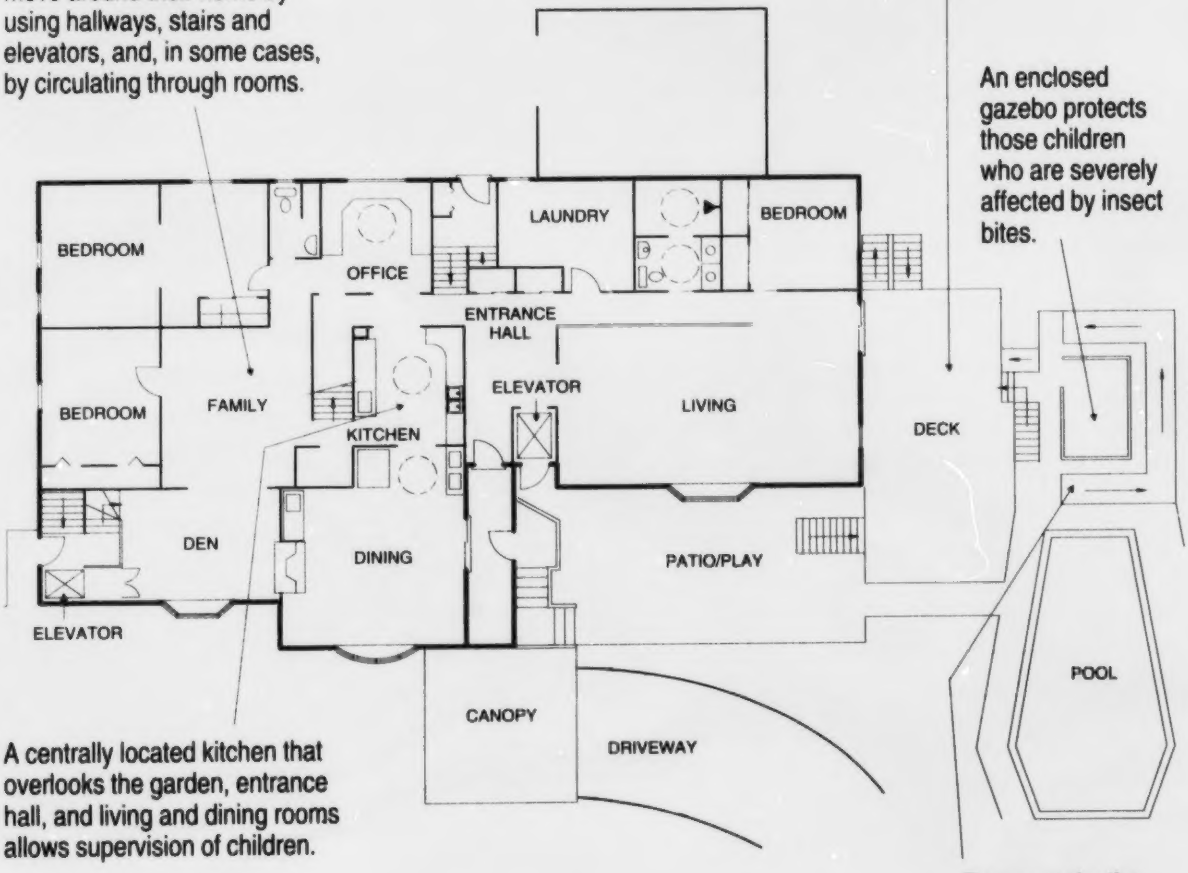
2 The accessible dining room enables all the children to enjoy mealtime together.

The Osborne Residence

For persons using wheelchairs, it is particularly important that hallways and connecting spaces be well designed. The Osbornes move around their home by using hallways, stairs and elevators, and, in some cases, by circulating through rooms.

A sundeck built at the same level as the living room provides unique opportunities for outdoor recreation.

An enclosed gazebo protects those children who are severely affected by insect bites.

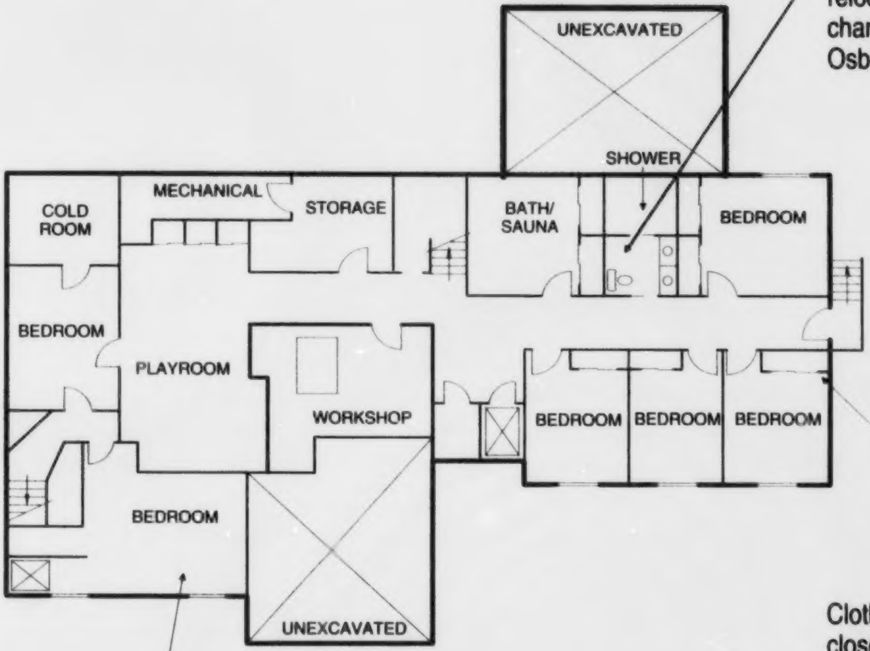

BEDROOM
OFFICE
LAUNDRY
BEDROOM
ENTRANCE HALL
BEDROOM
FAMILY
ELEVATOR
KITCHEN
LIVING
DECK
DEN
DINING
PATIO/PLAY
ELEVATOR
POOL
CANOPY
DRIVEWAY

A centrally located kitchen that overlooks the garden, entrance hall, and living and dining rooms allows supervision of children.

Ramps make the deck, gazebo, pool area and other recreational areas readily accessible.

3 First-floor plan.

The Osborne Residence


UNEXCAVATED
SHOWER
COLD ROOM
MECHANICAL
STORAGE
BATH/ SAUNA
BEDROOM
BEDROOM
PLAYROOM
WORKSHOP
BEDROOM
BEDROOM
BEDROOM
BEDROOM
UNEXCAVATED

Grab bars were installed on the side and rear walls of the toilet; the walls were reinforced extensively to allow the grab bars to be relocated or adjusted to the changing needs of the Osborne family.

Clothes rails and shelves in closets were also designed to accommodate the changing needs of the children as they grow.

The design of the rooms and the selection and arrangement of the furniture make all the bedrooms accessible to all the children, including those who use wheelchairs. This ensures that family members can visit and play with their brothers and sisters anywhere in the home.

4 Lower-level floor plan.

Mr. Keough's Home

The needs of a person who depends on a respirator because he cannot draw a single unassisted breath are unique and critical. For such a person, a decision to leave the security of an institutional setting for the freedom of a more independent lifestyle is both courageous and risk-filled.

For Mr. Keough, however, moving out of his hospital room meant the realization of a dream that had begun 16 years before when he was severely injured while watching a snowmobile race.

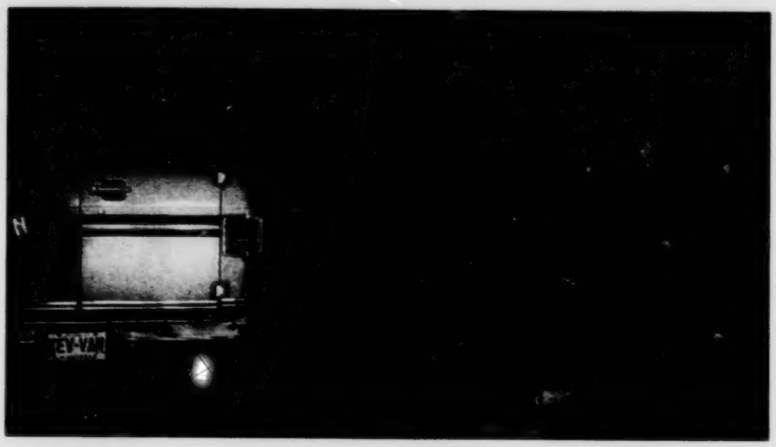
To minimize the risks and maximize his personal freedom, this determined 25-year-old approached the Independent Living Resource Centre in Winnipeg (see page 135 for information on this type of centre) to help him prepare for a life on his own. He needed assistance in selecting and adapting his home and training his attendants.

The house he selected required a number of adaptations and additions. The work included building a new garage with a ramp leading into the side door of the house. This not only gives Mr. Keough protection against inclement weather all year but also provides privacy for him when he enters or leaves his home. Since the ramp is concealed in the garage, his home looks no different from the rest of the homes in the neighbourhood — a design feature which Mr. Keough feels proud of. A new, accessible deck in the backyard enables him to enjoy the outdoors. A chair lift from the main floor to the basement gives Mr. Keough the freedom to move between floors, while a hoist leading from his bedroom to the bathtub makes bathing easy and enjoyable.

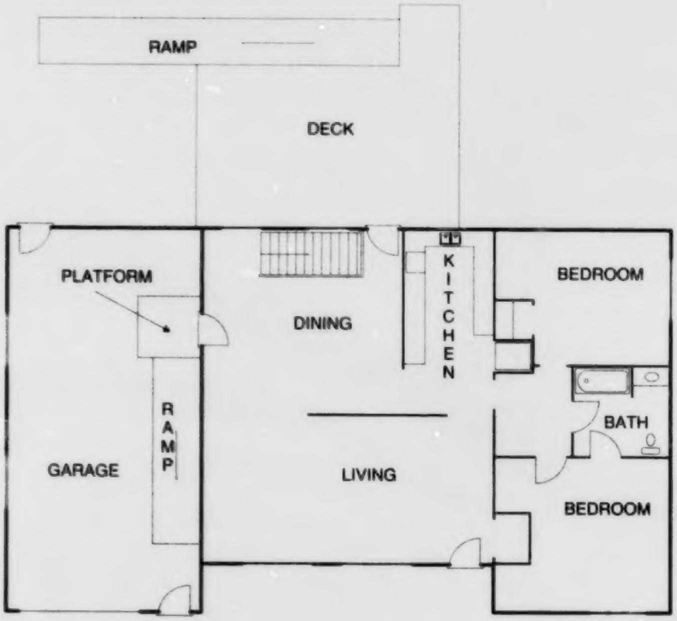
5 A chair lift makes it possible for Mr. Keough to use the basement level.

As most respirators must be plugged into a three-pronged wall socket, some electric rewiring was also necessary. To prevent circuits from overloading, each plug was

6 A new, accessible deck provides opportunities for outdoor enjoyment.



7 A ramp built inside the garage protects Mr. Keough from inclement weather. It also gives him some privacy when he is getting into or out of the van.



8 Ground-floor plan of Mr. Keough's home.

connected to a separate fuse or breaker. Additional electrical systems — alarms, security systems, environmental control units — were installed at the same time. An alarm system, including an outdoor siren and push-button backup, is necessary to alert his attendant to any interruption in the functioning of the respirator. The house is equipped with a small, gas-powered generator as a backup in the event of an electrical power failure.

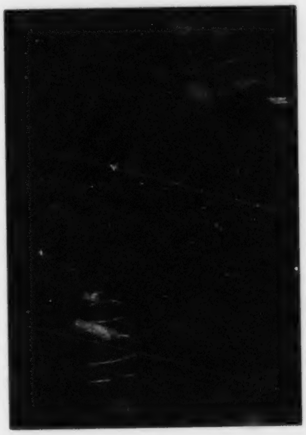
Because an attendant is needed in Mr. Keough's home on a 24-hour basis, overnight quarters had to be provided. Although a bedroom located away from the home's entertainment area would have been acceptable, a bedroom in the basement offered more privacy. ▲

Mrs. Chown's Home

When Mrs. Chown, a senior citizen living in Winnipeg, began to use a wheelchair, her life changed forever. The one and one-half storey house she had lived in for many years could no longer accommodate her needs, and she was compelled to move. Reluctant to leave the community she had grown to love, however, she bought a one-storey house that did not have a basement, stairs or outside steps, and had it custom-renovated.

Renovations included the installation of a small ramp at the front and back doors to allow access in a wheelchair; the widening of the bedroom doorway; the installation of rocking light switches; and, in the kitchen, the installation of a wall oven, stovetop and single-action faucet for the sink.

9 A number of handrails throughout the home make it easier for Mrs. Chown to get around.



10 The easy-to-reach raised flowerbeds enable Mrs. Chown to enjoy gardening.

A number of handrails throughout the house allow her to move freely with her canes or walker. A grip pole, secured to the ceiling and floor rather than a wall, offers flexibility and can be positioned wherever it is needed. The home's two bathrooms underwent a number of changes. Both toilets were modified; the seat of one was raised and support arms were added to the other. Grab bars and a portable bath seat were installed in the ensuite bathroom; a gravity-activated bath seat was installed in the tub of the main bathroom.

Because Mrs. Chown's garden is particularly important to her, several outdoor enhancements make her home complete. A number of easy-to-reach raised flowerbeds provide her with tremendous gardening opportunities. New, safe walkways using wide patio stones connect the main entrance of the home with the street sidewalk. A supportive handrail leads from the garage to the house. A screened patio gives Mrs. Chown an opportunity to enjoy the outdoors in the summer. An underground sprinkler system enables her to keep the garden green.

11 A monitoring station.

Mrs. Chown wears a small remote-control device, activated by a button, which is connected to a monitoring station so that she can summon help in the event of an emergency. She can also use this device to answer the telephone or door. ▲

The Himal Residence

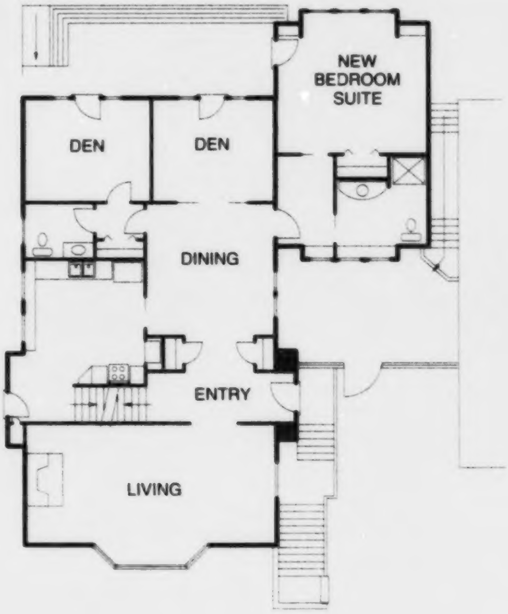
To provide their son, Monty, who has a neurological disability and uses a wheelchair extensively, with greater opportunities for independent living, Dr. and Mrs. Himal enhanced their home with extensive renovations. They also built a two-storey, barrier-free addition onto the side of the house when the old garage was demolished, and carried out some thoughtful landscaping around the house.

Before the renovations, entry to the Himal house required climbing a flight of 14 steps from the driveway to the front door. An outside ramp was considered to be neither a pleasing nor a practical solution to access the house. The Himals therefore decided to lower the driveway and create a new entry court, which is on a level with the lower floor of the residence. An interior chair lift connects the new lower-level entrance hall with the main floor.

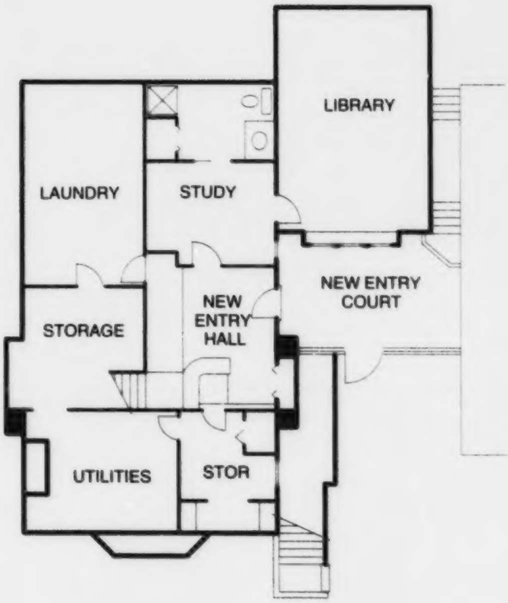
The addition includes a new bedroom suite on the main floor and a library, which overlooks the new entry court, on the lower floor. The new bedroom suite, visually separated from the main living area by its own vestibule, enables Monty to participate more fully in family activities. An ensuite, barrier-free bathroom enables him to enjoy greater independence. A bay window harbours a computer table and offers a sweeping view of the backyard, while a glass door gives a view of the new terrace and direct access to the rear garden.

The lower level of the addition was designed so that it can be easily converted into a small apartment for Monty in the future. The space adjacent to the bath can be turned into a small kitchen and the library into a bed/sitting room.

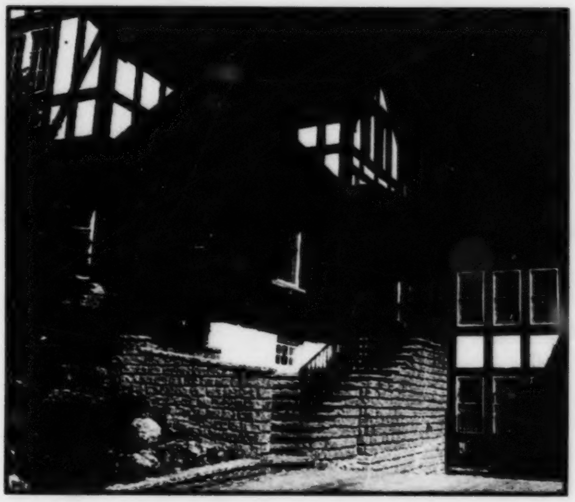
Every part of the rear garden is wheelchair-accessible. A new stone terrace at the main-floor level means there is no threshold between the interior and exterior of the house.



12 The main-level floor plan after renovation.



13 The lower-level floor plan after renovation.

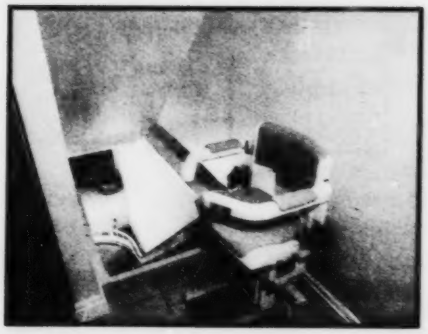


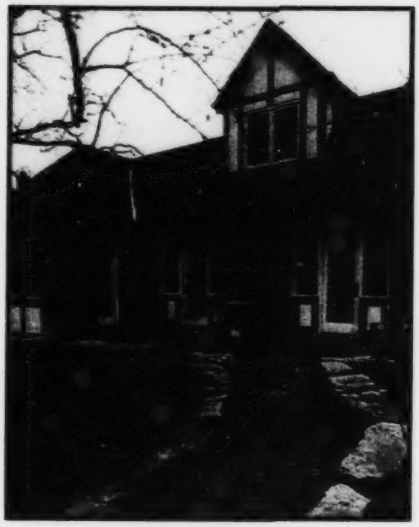
14 The lowered driveway provides accessible entry to the lower-floor level of the residence.

15

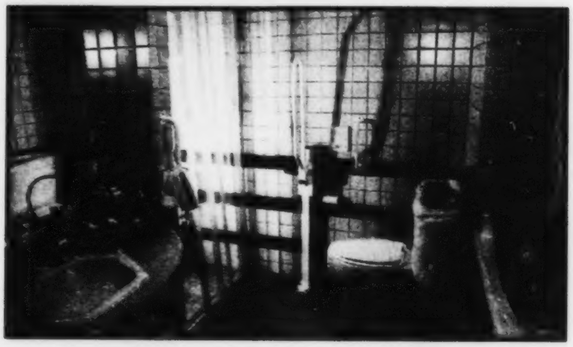
A chair lift connects the new entry hall (15) to the main floor of the house (16).

16





17 Innovative grading and landscaping make the backyard attractive, yet barrier-free.



18 A wheel-in shower stall, an accessible washbasin, flexible grab bars and a thoughtful bathroom layout have given Monty a measure of independence.

A pathway leads from the terrace to the garden and to another sheltered terrace. Accessibility into the garden is provided through thoughtful and innovative grading and landscaping as opposed to ordinary ramps.

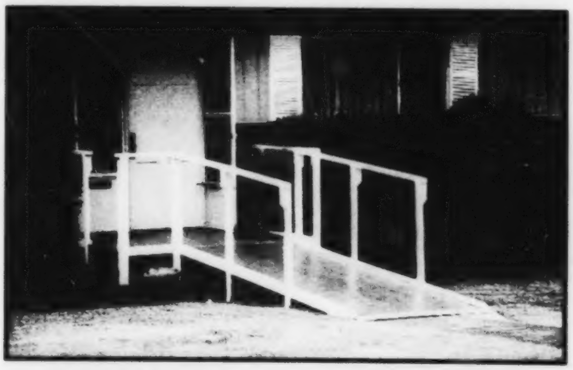
Despite their functional nature, all of the special features of the Himal house were designed in such a way that they do not visually dominate the home or impart a clinical atmosphere. Nevertheless, they achieve the overall design objective of making the home as barrier-free as possible for Monty. ▲

The Strand Residence

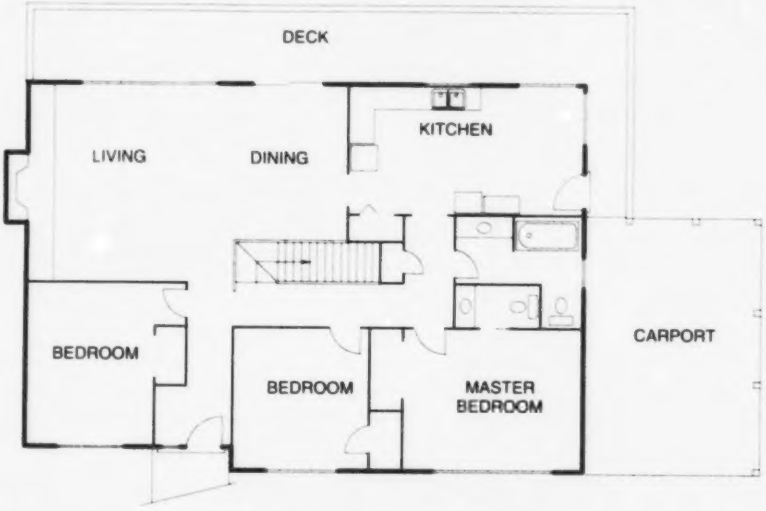
The desire to maintain independence and remain in the comfortable surroundings of one's home is paramount for most people. How to do so if one is visually impaired and relatively immobile is not an insurmountable problem.

For Mr. Strand, of Vancouver, a middle-aged man who has limited vision, only in his right eye, and has difficulty getting around his home because of a neck fracture, it was important that his surroundings be functional yet pleasing. Renovations and a new addition have helped him realize his dream of staying in his own home. The changes enhance the existing design and have not jeopardized the home's resale potential.

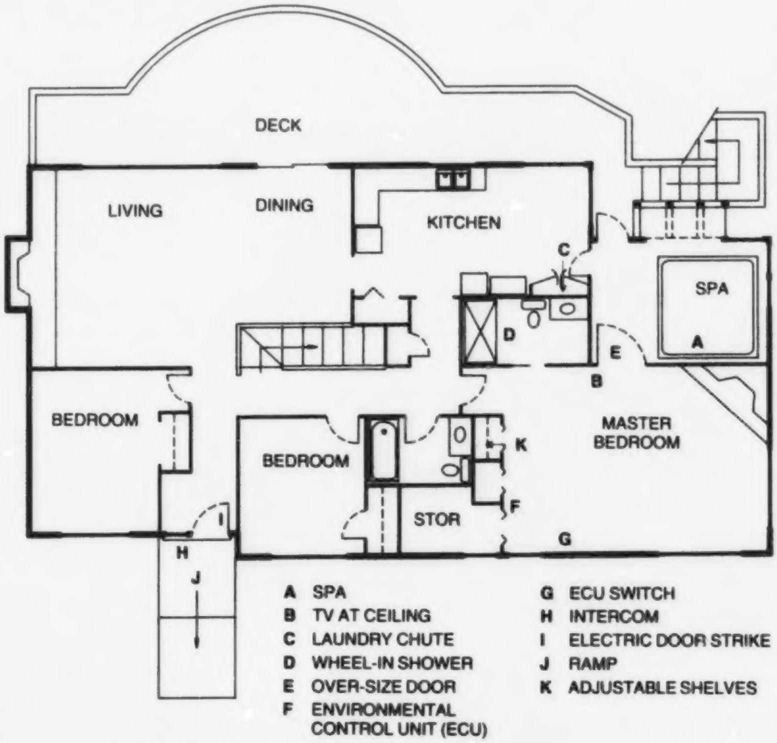
Many of the modifications are subtle and would appeal to most consumers. They include orienting the bedroom's visual field to the right to take advantage of the pleasing view; mounting the television from the bedroom ceiling; putting in a hot tub for heat therapy and relaxation; installing a laundry chute; enlarging the sundeck; and installing remote-control switches for the television, front door, intercom, stereo, phone and environmental control unit. A new ensuite bathroom with a wheel-in shower stall and a removable ramp at the front entrance



19 A new ramp makes the house much more accessible.


DECK
LIVING
DINING
KITCHEN
BEDROOM
BEDROOM
MASTER BEDROOM
CARPORT

20 The original floor plan.


DECK
LIVING
DINING
KITCHEN
SPA
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MASTER BEDROOM
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STOR
F
G
I
H
J
A SPA
B TV AT CEILING
C LAUNDRY CHUTE
D WHEEL-IN SHOWER
E OVER-SIZE DOOR
F ENVIRONMENTAL CONTROL UNIT (ECU)
G ECU SWITCH
H INTERCOM
I ELECTRIC DOOR STRIKE
J RAMP
K ADJUSTABLE SHELVES

21 The main-floor plan after renovation.

22 The ensuite bathroom, built as part of the new addition, contains a wheel-in shower stall.

23 An oversized door between the bedroom and hot tub can be closed for privacy or opened to provide a view of the river valley.

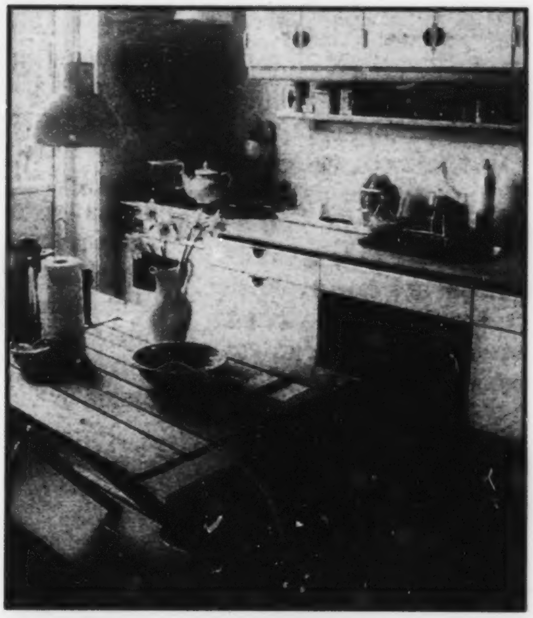
also make daily living much easier for Mr. Strand, who has a live-in companion to provide attendant care.

An oversized door that looks like a wall is placed strategically between the master bedroom and the hot tub. It can be closed for privacy or opened to afford Mr. Strand a view of the river valley from his bed. ▲

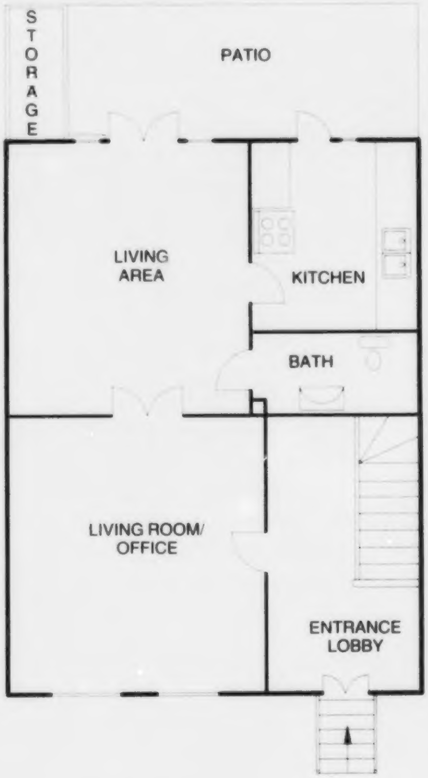
Mr. Koch's Home

In Denmark, one of the main trends is toward maintaining integration of all citizens, old and young, with and without disabilities, in ordinary residential neighbourhoods. Therefore, it is important that the existing housing stock, much of which is old but very well located, be adapted as the needs of families and individuals change.

For older people who find it increasingly difficult to go up and down stairs, one option is to install a chair lift for access to the second floor. Another is to adapt the ground floor of a two-storey house to create a self-contained apartment. The second floor can then be occupied by a tenant, who looks in on the older person from time to time. A retired architect



24 A stove with front controls, easy-to-use faucet, accessible shelves, drawers and cupboards that are easy to open, and an adaptable sink make this kitchen ideal for someone with decreased mobility.



24 Ground-floor plan of Mr. Koch's adapted home.

who has a great deal of difficulty getting around. Mr. Koch, a resident in a suburb of Copenhagen, Denmark, has chosen this second option. He rents the second floor of his row housing unit to a university student.

Various items needed by Mr. Koch during the day are placed on a trolley, which he wheels around with him. An intercom by the front door, a remote-control voice-answering system, a portable telephone and a phone with direct connections to his son and to an ambulance service provide convenience and security. Mr. Koch has also arranged for regular support services: one brings him a hot meal at lunch, and a morning homecare worker prepares his other meals and helps with cleaning and shopping.

The modifications Mr. Koch has made to the downstairs reflect his own experiences with design and form, and take into account his activities and needs throughout the day. A downstairs bathroom, installed when Mr. Koch's wife became ill, was built between the kitchen and the front room in such a way that the floor layout has not been compromised. Now a widower with his own mobility problems, Mr. Koch finds the bathroom very convenient, with its hand-held shower, wall seat and high toilet. The living room, serving as a combination den, sitting area and office, is connected to a dining room by a big double door, which can be opened to create a larger space.

These types of adaptations help individuals such as Mr. Koch to remain living at home, in their communities and in familiar, comforting surroundings.

Other houses in the block where Mr. Koch lives are being renovated. His neighbour, for example, has renovated her kitchen to accommodate her own unique needs and preferences. Grooves instead of handles for drawers to offer better gripping capability; lighting fixtures placed strategically over eating and meal preparation areas to improve visibility; and specially designed shelving with compartments and indicators for various meal plans to help in overcoming slight cognitive difficulties: these are some of the adaptations found in her house. ▲

Community-Based Initiatives

In Europe, where a substantial portion of the existing housing stock is quite old, countries concerned about integrating people with disabilities into mainstream society are looking at ways to renovate heritage buildings. Many of these buildings are not easily adaptable to people's changing needs, and Europeans are also sensitive to the need to preserve their cultural and architectural heritage.

Despite difficulties, it is proving to be possible to adapt heritage buildings to meet the needs of persons with disabilities in ways that reflect sensitivity to the past. The examples in this section — the building modification programs in Sweden, Switzerland, France and Canada and the Disabled Persons Housing Service in Great Britain — highlight the individual responses of various countries to the renovation of the building stock, much of it old, to accommodate persons with disabilities.

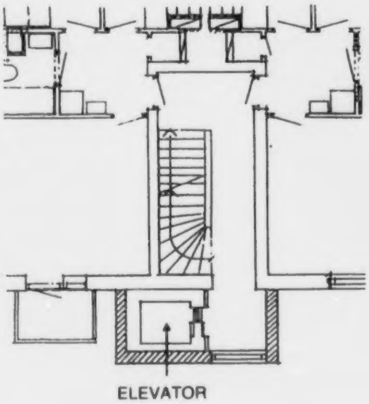
The Swedish Experience

Swedish people believe strongly that people with disabilities should have the same opportunities and obligations as other citizens. Reflecting this view, it has been a policy objective of the Swedish government since 1985 that people with disabilities have a right to a home in an ordinary housing environment that promotes active involvement in the community.

It is a municipal responsibility to see that all people have a sound and well-planned dwelling that corresponds to their needs. Building code requirements and design practices ensure that all new buildings have good accessibility and that interior spaces and facilities are usable by people with disabilities. This makes it possible for the majority of people with disabilities to live and function in a normal dwelling with only minor adaptations being necessary to meet individual needs.

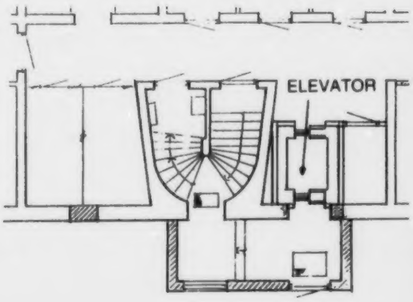
While good results are being achieved in new dwellings, these represent a very small proportion of the total housing stock. In Sweden, the real challenge is the old housing stock. Between 1965 and 1974, over 100 000 new dwellings were built each year under the "Million Program." In the 1980s, problems relating to building conditions, mobility and accessibility became critical in older districts and residential areas, where many elderly people live. As a result, the renovation and improvement of the old housing stock to meet the needs of people with disabilities has become an important issue and is receiving increasing attention.

In recognition of the growing need to adapt older dwellings and the potential need to eventually modify new dwellings, the Swedish Housing Adjustment Grant is now available to enable people with disabilities to adapt their homes so that they can continue to perform primary activities of daily living, such as preparing meals, doing the laundry, bathing and



26 An elevator housed in a small addition adjacent to a stairwell.

27 Exterior view of addition.



28 An elevator installation inside the building, with a new street-level entrance.

29 Exterior view of the street-level entrance.

managing personal hygiene, as independently as possible. Most of the adaptations under this program are to bathrooms and kitchens, though the widening of doorways to improve accessibility is common. Other adaptations include installing automatic door openers in garages, installing new ramps, repairing entrance walkways and installing elevators to facilitate access to older, single-family homes. Approximately 35 000 dwellings are adapted each year.

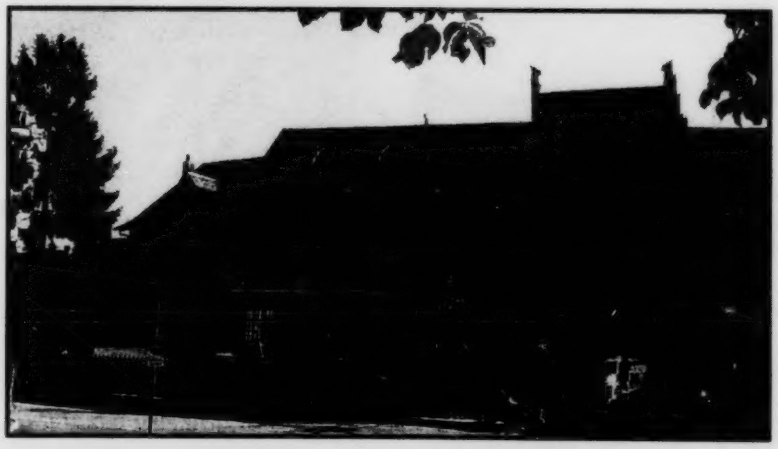
There are many old, three-storey buildings without elevators in Sweden. To stimulate the rehabilitation of these buildings, a special grant was established, from 1984 to 1990, to promote the installation of elevators in buildings of three storeys. The Elevator Grant Program — a 50 percent subsidy of capital costs — encouraged owners of apartments of three storeys predating 1977 to install accessible elevators.

The Sanna district in Göteborg, built between 1940 and 1945, is one community where an extensive renovation program was carried out between 1984 and 1986: 10 elevators were installed, making 40 percent of the apartments accessible. Under the program, two different methods were used to install elevators, depending on the physical characteristics of the building. In some cases, a small addition was made adjacent to a stairwell, enhancing the appearance of the building; in other cases, elevators were installed in the interior and so are not visible from the outside. Some elevators are accessible from the basement level, while others have special entrances at the street level. In all cases, they were installed to create maximum accessibility with as little disruption as possible. ▲

"Stein am Rhein": A Swiss Example

Many buildings in Switzerland are very old, and both the public and private sectors are involved in the renovation of much of the housing stock to make it accessible to persons with disabilities.

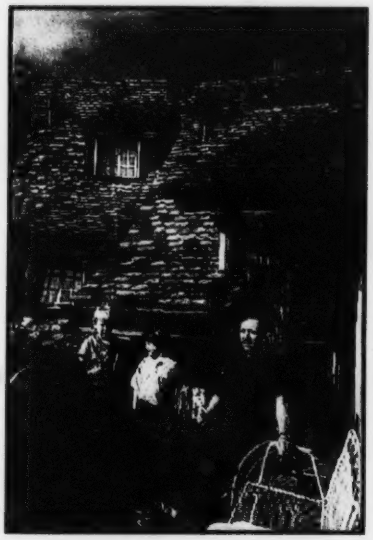
A particularly interesting example is a 550-year-old mansion, which was renovated and modified to create 14 self-contained apartments. Of these, eight are fully accessible to people using wheelchairs and five are partly accessible. Only one dwelling directly under the roof is not accessible to persons with physical disabilities. The overall approach was to eliminate as many design barriers as possible so that all the apartments offer basic features to meet the needs of persons with varying disabilities: wider doorways, absence of thresholds, generous and well-planned floor plans, and accessible bathrooms and kitchens with easy-to-use furniture, equipment and fixtures. Other, more extensive modifications



30 "Stein am Rhein" from the street.

were made to meet the specific needs of individual occupants.

Easy access throughout the entire building, including the parking and recreational areas and shops, is now possible for people using a wheelchair. This was achieved by removing door thresholds, widening doorways and installing an elevator that serves all floors. ▲



31 Low thresholds allow easy access to the balconies.

32 One of the apartment kitchens.

33 An accessible shower area has been created next to the original bathtub.

34 A removable rubber curb contains the water within the shower area.

"Saint-Quentin" and "La Mayenne": Two French Examples

Making the overall environment — the home, the streets, the parks, the transportation system — accessible and usable for all citizens is a universal policy and a way of life in France. A number of community-based organizations have worked hard to ensure that accessibility for all becomes a reality. This section describes two major local initiatives.

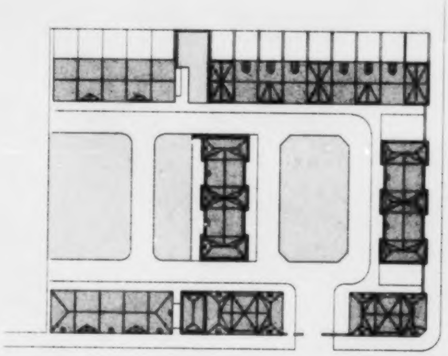
The Renovation of "Les Béguinages de Saint-Quentin"

Thanks to the extensive and thoughtful renovation efforts of the City of Saint-Quentin, low-income seniors are able to live in a variety of dwelling units well designed to enable them to remain where they are as they age. What makes this particularly special is that the municipality was able to renovate its older *béguinages* units — 14 heritage housing sites scattered throughout the city and comprising 289 dwellings — to accommodate many elderly occupants who experience reduced mobility. The work included the complete renovation of the various sites, as well as the individual dwelling units.

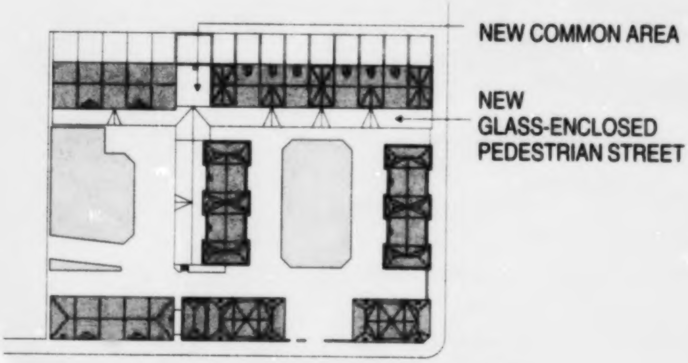
Communal facilities were created in a common area at each of the sites, including a dining room, meeting room, games room and washrooms. The common area is linked to 40 percent of the dwellings by a glass-enclosed, barrier-free pedestrian street. The objective of including the communal facilities and enclosed walkways is to provide increased opportunities for mobility, recreation and socialization for residents, particularly those with disabilities.

Dwelling unit renovations included major restructuring of interior spaces, barrier-free design provisions and the replacement or installation of equipment and fixtures in bathrooms and kitchens to meet modern building standards. All bathrooms are now generously sized and are equipped with grab bars and a shower area with a lift-up seat that allows people to take a shower while seated. Previously, the few elderly people who lived in these housing complexes had to resort to using communal washroom facilities that were less than adequate.

One of the major goals of the renovation program was to create a number of dwellings specifically designed for people with disabilities, including those using wheelchairs.



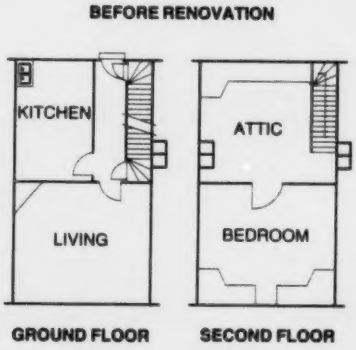
35 Site plan before renovation.

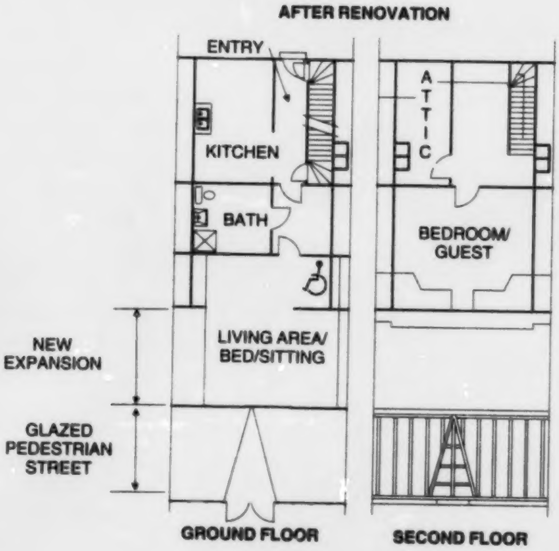

NEW COMMON AREA
NEW GLASS-ENCLOSED PEDESTRIAN STREET

36 Site plan showing the new common areas and glass-enclosed pedestrian street.

37 The historic *béguinages* units, after renovation.

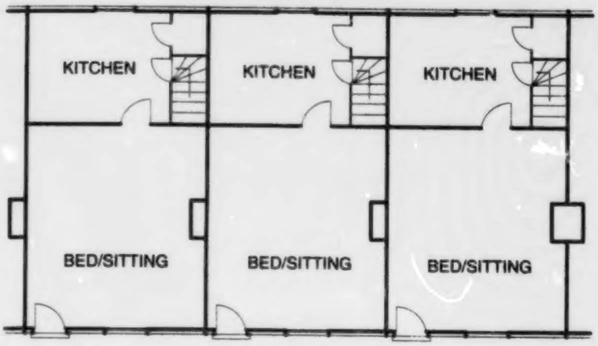
38 A glass-enclosed pedestrian street links almost half of the units to the common areas.


BEFORE RENOVATION
KITCHEN
LIVING
ATTIC
BEDROOM
GROUND FLOOR
SECOND FLOOR

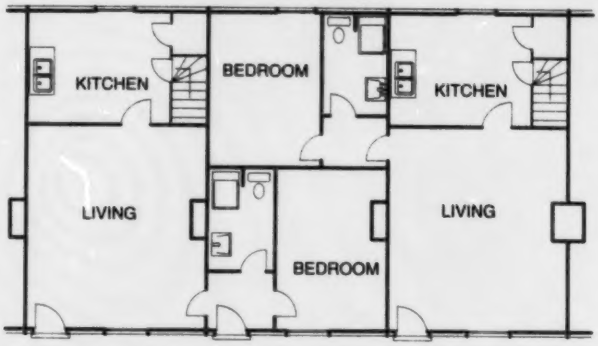

AFTER RENOVATION
ENTRY
KITCHEN
BATH
LIVING AREA/ BED/SITTING
NEW EXPANSION
GLAZED PEDESTRIAN STREET
ATTIC
BEDROOM/ GUEST
GROUND FLOOR
SECOND FLOOR

39 Floor plans of the two-storey dwelling: ground and second floors before renovation; ground and second floors after renovation.

BEFORE RENOVATION



AFTER RENOVATION



40 Floor plans of the one-storey dwellings: before renovation; after renovation.

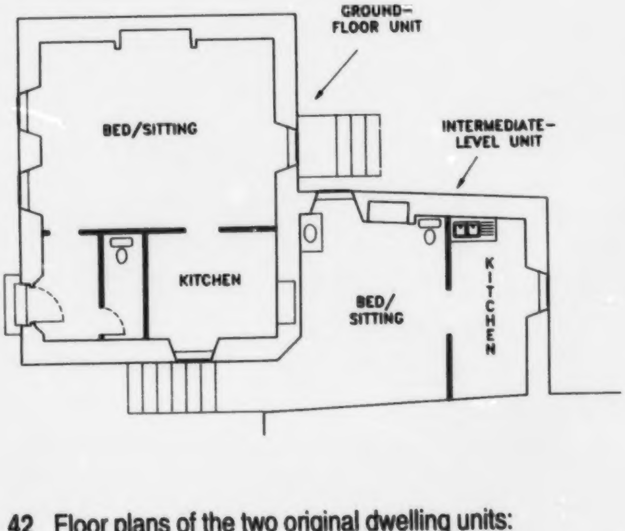
These units were to be located as close as possible to the common area. To achieve this goal, two types of dwelling units were created. The one-storey units were a particular challenge because they were originally not large enough to accommodate the needs of persons using wheelchairs. For these, the architects decided to combine three units to create two fully accessible units (see drawing **40**). To create the two-storey flexible dwellings, the architects extended the ground floor of the original dwellings to provide a self-contained unit with a bed/sitting area on the ground floor and a separate bedroom on the second floor. If the occupants are unable to use the second-floor bedroom because of a disability, they can use the bed/sitting area downstairs. The second bedroom can then be used as a guest room (see drawing **39**).

A Pilot Demonstration in "La Mayenne"

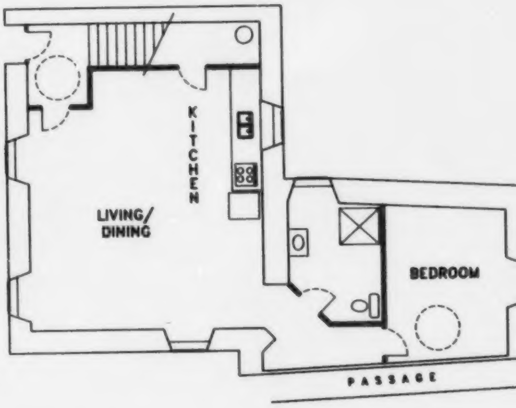
Making existing housing physically accessible to people with disabilities is a major objective of l'Agence Nationale pour l'Amélioration de l'Habitat (ANAH) in France. ANAH recently financed a pilot demonstration in the town of Nuillé-sur-Vicoin in the province of La Mayenne to make 20 heritage houses completely accessible for people with reduced mobility.

One part of this project consisted of renovating a two-storey building that contained three small units, ranging in area from 30 square metres to 50 square metres, on three levels, the ground floor, an intermediate level and the second floor. As the original floor plan shows (see drawing **42**), the steps at the entrances to these dwellings presented a major challenge to the renovators. Another challenge was the lack of space in both the ground-floor and intermediate-level units to accommodate the needs of today's households. After exploring a

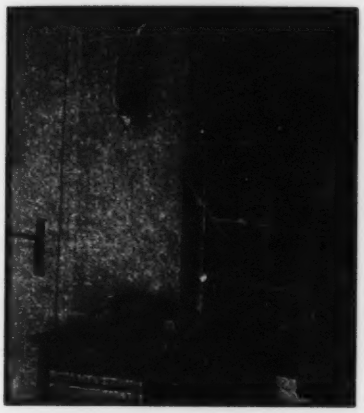
41 One of the heritage houses after renovation.



42 Floor plans of the two original dwelling units: ground-floor unit; intermediate-level unit.

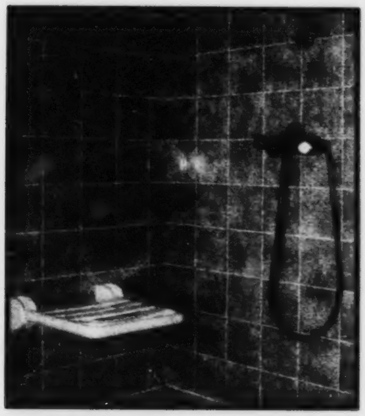


43 Floor plan of the new dwelling unit.



44 The door hardware, telephone and control switches are easily accessible.

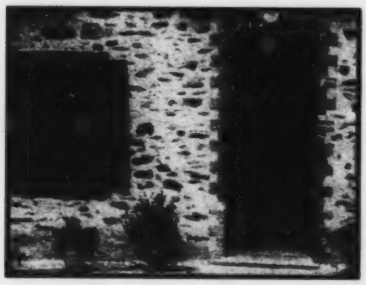
45 Low window sills allow people using a wheelchair to enjoy the view. T-handles are easy to operate and within reach.



46 Bathing is easier in a shower area with no threshold and a lift-up shower seat.

number of options, the owner of the building decided to combine the units on the ground and intermediate floors to create a larger and fully-accessible one-bedroom apartment (see floor plan after the renovation, **43**).

The work included creating a new street entrance in a location where steps were not needed (by taking advantage of the slope along the sidewalk); demolishing the original floor of the intermediate-level unit and constructing a new floor at the same level as the floor of the ground-level unit; and providing internal connections between the two original units. The main living spaces and the kitchen of the new dwelling now occupy the space of the original ground-floor unit, and the bedroom and bathroom are located in the space of the original intermediate-level unit.



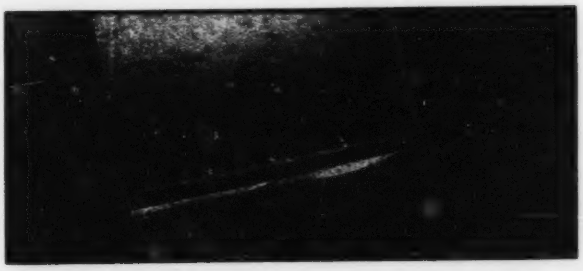
47 A floor drain by the front door prevents water buildup and eliminates the need for high thresholds.

Interior design features include a 1.5 metre turning radius for a wheelchair in all rooms; a kitchen sink with knee space; flexible shower head and thermostatic water controls; a washbasin mounted on wall brackets with accessible and easy-to-use faucets; a shower area with no thresholds; and window and door hardware and environmental control switches that are within reach of a person using a wheelchair. The renovation resulted in a charming and completely accessible house. ▲

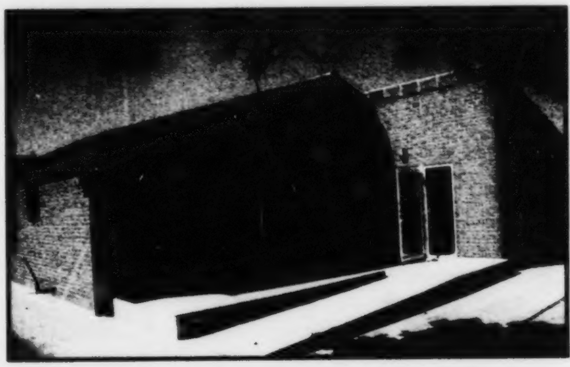
"The Disabled Persons Housing Service": An Innovative British Model

Persons with disabilities living in Derby, England, have access to a unique "one-stop" housing service, thanks to a comprehensive, multi-functional and multi-disciplinary agency set up by the Walbrook Housing Association. Established in 1985, the Disabled Persons Housing Service (DPHS) carries out a variety of functions designed to help people with disabilities with their housing. These include providing general advice on housing design, technical aids and equipment, housing options, financing and cost-estimating. The DPHS also provides general counselling and training; and devises ways of packaging care services.

The DPHS uses a holistic and professional approach to find suitable housing for people with physical disabilities and enhance the quality of life of its clients. Housing advisers, who are qualified occupational therapists, map out specific criteria to meet each individual's needs by tapping into various professional resource networks that include architects, housing managers, maintenance workers, financial and management experts, and designers of technical aids. Integral to the service's success are two components: intense client involvement throughout the assessment process; and an assessment/training flat (see page 138), where clients can practise in private to acquire skills that will help them live independently.



48 Eliminating thresholds improves accessibility.

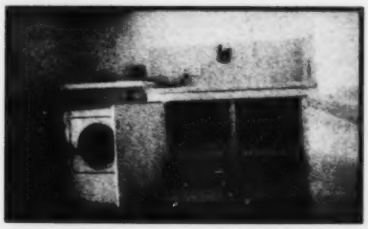


49 A concrete ramp was installed to make the backyard accessible to J.

50 This toilet has adjustable arm supports and gives a wash and blow-dry.

One of DPHS's success stories involves a young man (J.), who was severely injured in a car accident that left him a quadriplegic. Determined to live on his own and in the same neighbourhood as his relatives, J. consulted with a DPHS housing adviser, who was able to track down a builder who was about to construct four bungalows. The adviser helped J. use his accident compensation funds to purchase one of the bungalows before it was built. Once J.'s abilities were assessed, the adviser was able to work with the builder and J. to custom-design the bungalow to meet his needs.

J.'s new home has easy-to-pull drawers in the laundry room; the kitchen countertop has been built so that pots can be slid onto the stove with ease; and the washbasins have been lowered, making it easier for J. to rest his forearms. At the touch of a button, J. can also command his toilet to give a wash and blow-dry, which preserves his dignity and privacy.



51 J.'s laundry area features pull-out drawers and easily reached controls.

52 The pots can be slid onto the stovetop with ease. Space is provided under the stove and worktops.

This type of toilet, also available in North America, is easy to operate and is proving to be a boon for people who find it difficult to attend to personal hygiene. It features a shower arm providing a warm water spray (adjustable in intensity and position) to provide a thorough, gentle cleansing; a self-cleaning nozzle; and controls that activate the drying function (adjustable for the user's comfort level) and warm the seat in advance of use. ▲

Home Modification Programs in Canada

The promotion of independence for people with varying types of disabilities — mobility, visual, hearing, cognitive or allergy-related — is the prime goal of the federal government's Residential Rehabilitation Assistance Program (RRAP) for Disabled Persons. Homeowners and landlords can make buildings more accessible with loans provided through the Canada Mortgage and Housing Corporation (CMHC), which are also cost-shared with the provinces of New Brunswick, Quebec and Newfoundland. A portion of the loan may not have to be paid back. In the case of homeowners, the amount of the non-repayable portion depends on the household's income.

CMHC has provided assistance for accessibility modifications under RRAP since 1982. In an effort to focus on the housing needs of those with disabilities, the Corporation made RRAP for Disabled Persons a separate component in 1986. Since then, over 10 000 units have been modified.

In addition, provinces and territories, including Ontario, Saskatchewan, Alberta and the Yukon have complementary programs that

53 Combined assistance through RRAP-D and HAP make major modifications possible.

provide further assistance to persons with disabilities living in their respective regions.

In Alberta, for example, homeowners, tenants and landlords can receive grants of up to $5,000 through the Home Adaptation Program (HAP) to modify housing units to make them more accessible to wheelchair users or to persons with severe mobility problems. Of this grant money, up to $700 can be used to purchase an approved medical alert unit.

To be eligible, a homeowner, tenant or some other resident in the house must use a wheelchair or have a severe mobility disability that will eventually require the use of a wheelchair, and meet income and residency requirements. The maximum eligible household income is $30,000 per year, but many clients rely on Assured Income for the Severely Handicapped or (if senior citizens) Alberta Assured Income Plan benefits. Landlords must be willing to modify an existing residential building, or to construct a new residential building, to accommodate one or more wheelchair users; they must also agree to try to rent the adapted units to eligible tenants for at least three years.

Actual modifications and funding allocations are agreed between the grant recipient and Alberta Municipal Affairs. Typical modifications made under this program include installing ramps and sloped walkways to provide access to the unit; eliminating high thresholds; providing handrails, wheelchair lifts and easily operated door-opening and -closing devices; widening doorways; modifying kitchen and bathroom cabinets and installing grab bars; and providing security devices, including alarms and medical alert systems. ▲

CHAPTER 4

Converting Existing Buildings

• •

With so much emphasis now being placed on the need to reduce waste and reuse or recycle materials, it is appropriate and important to find ways to give a new lease on life to buildings whose usefulness has apparently been spent.

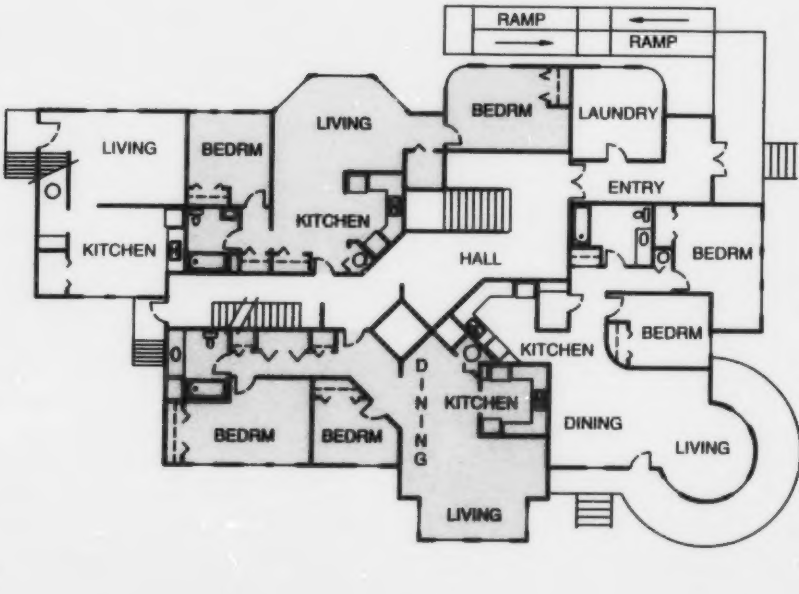
The following examples are highlighted because they illustrate ways of giving new life to difficult-to-convert buildings — an old mansion, a school, a number of industrial buildings and a motel — as well as providing accommodation for people with a range of disabilities.

Pinehurst

One way to increase the stock of available accessible dwellings is to convert existing buildings. With this in mind, the Capital Region Housing Corporation of Victoria, British Columbia, accepted a developer's proposal to convert a neglected but magnificent heritage mansion into a non-profit, nine-unit apartment complex. Two of the new apartments on the ground floor are designed to accommodate people with disabilities. A ramped entry provides wheelchair access from the street without being a dominant feature of the building's facade.

The conversion project has not only increased the local stock of affordable, accessible housing but has also enabled the community to reclaim one of its fine historic properties. ▲

54 This heritage mansion in Victoria now contains nine apartment units.


RAMP
RAMP
BEDRM
LAUNDRY
LIVING
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ENTRY
KITCHEN
KITCHEN
HALL
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DINING
KITCHEN
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LIVING
LIVING

55 Plan of the main floor, showing how four two-bedroom apartments were created around the wide central hallway.

Habitations Quesnel

A school closure often represents the last stage in a hard-fought battle lost to declining enrollment. Its doors closed and its usefulness apparently spent, the purpose-built structure may stand empty and neglected for years.

56 Once a school, now home for a mix of families and single people, including people with disabilities.

Such was the case with an old school on rue Quesnel in Montréal. Ten years after closing down, the building was transferred to the city and then leased to a non-profit group founded by paraplegics and quadriplegics, Société Logique, with the stipulation that it be converted to housing. Today, the converted 17-unit apartment building, which has been made universally accessible, accommodates a population that generally reflects the proportion of families with children, single persons, seniors and people with disabilities found in Canada's population. In this way, Société Logique has ensured the complete integration of these various population groups in its project.

For its conversion to apartments, the building was largely gutted, leaving only structural interior walls, columns, beams, floors and the outside shell. All the windows were replaced, and an elevator and two ramps were installed.

In the apartments themselves, a number of design features make the units universally accessible: wheelchair-turning circles in entranceways, corridors, bathrooms and kitchens; wide doorways; and sliding pocket doors in some bathrooms; kitchen countertops positioned midway between the standard height and the height generally used for people using a wheelchair; upper kitchen cabinets and light switches placed lower than normal; pull-out work surfaces in kitchens; and electrical outlets placed higher than normal.

Consideration was also given to future improvements that might prove necessary. Near the bathtub and toilets, walls were reinforced to allow for the installation of grab bars. At the front entranceway, an automatic door opener has been roughed in. These provisions will help to prevent complicated and costly renovations. Contrasting colours and different textures are used in common locations like corridors and laundry rooms to assist the visually impaired.

Habitations Quesnel is evidence that universally accessible housing does not necessarily cost more to build than ordinary housing. The architects found that the principles of universal design were easier to incorporate than originally envisioned because of the spaciousness of the existing building. An important benefit of this type of conversion is that it provides dwellings in established neighbourhoods. ▲

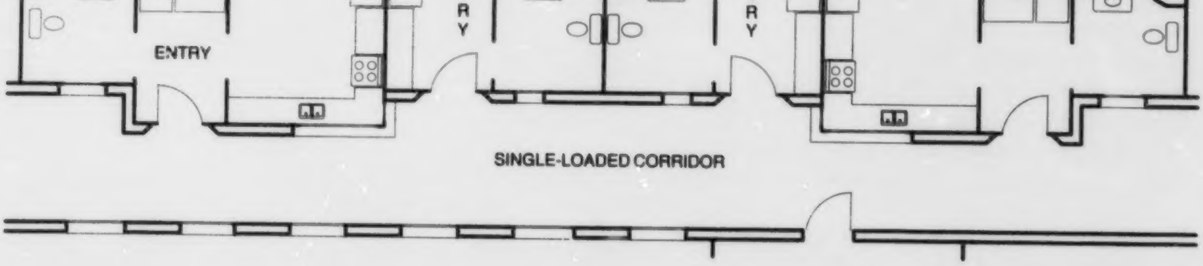
Recycling Old Factory Buildings: A Danish Example

In most cases, the older building stock in Denmark is extremely well located in the central parts of the municipalities. Because these buildings are near transportation networks, shops and other amenities, their conversion to housing for everyone is particularly appropriate. Moreover, the renovation of the country's heritage stock means that a part of Danish architectural history can be preserved for future generations to enjoy.

One particularly innovative project involved a heritage textile mill, which had been standing vacant in the central core of Thisted for some time. The project, undertaken by the municipality, took six years to complete and is an excellent example of sensitive conversion to create accessible housing. The housing is designed to accommodate single people, both young and old, including those with disabilities.

57a An aerial view of Thisted's renovated textile mill, now home to young and old single people, showing the glazed link between the two buildings.

The original stone structures of the mill were retained. Glass-enclosed galleries link two of the buildings to a central lobby that contains an elevator and staircase. Gates, passageways and



57b The single-loaded corridor enables the existing facade to be retained. The windows were removed and the openings left unglazed.

58 Handrails that extend well beyond the top of the stairs and elevator with accessible and easy-to-use controls.

59 This type of window handle is easy to use.

60 Lightweight sliding pocket doors are easy to operate with this type of handle.

small green spaces have been used to create private areas where people can socialize.

The entrances to the apartments and some of the room windows face onto an interior single-loaded corridor. This has avoided any need to modify existing window openings and enabled the existing facade to be retained.

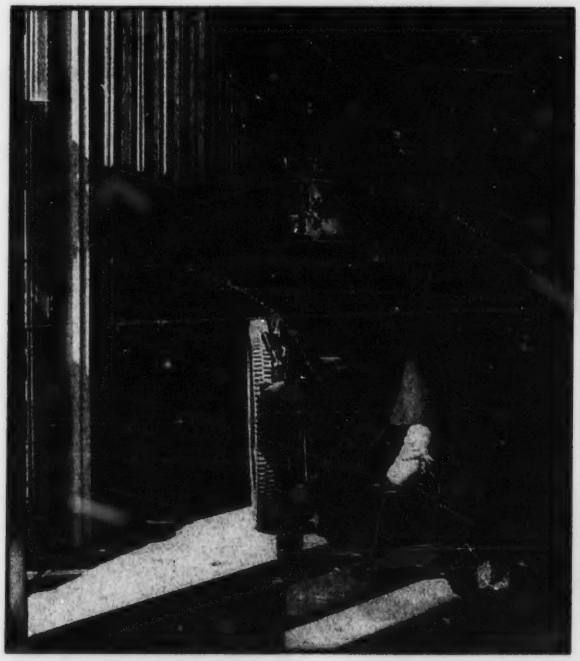
The main objective of the renovation at Thisted was to create a safe housing environment that promotes and supports independence and fosters interaction among the residents. Design features intended to make individual apartments more accessible and usable by everyone who might reside in them include easy-to-use hardware on doors and windows; appropriately placed handrails along stairs; good lighting throughout the building; and adjustable-height kitchen cabinets. Also noteworthy is the innovative colour scheme: sky blue accents on black walls, royal blue doors and a turquoise tower serve as visual signposts for persons whose vision is limited.

Experience is showing that young and old single people enjoy living side by side in this housing complex. They also appreciate the opportunity to live in the city, close to stores, services and activities, and this is particularly important to those residents with disabilities. ▲

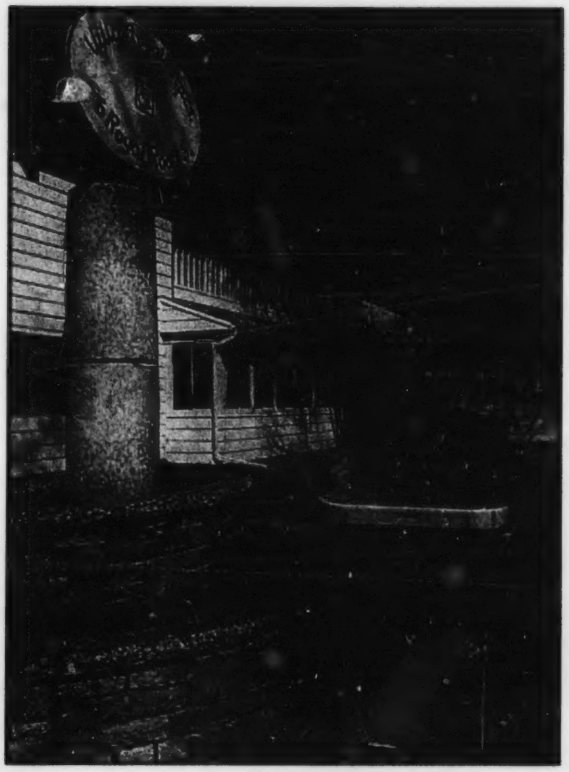
Villa Royale

The built world is full of conversion potential, if one applies some vision — which is what one private-sector developer did when he took an old motel in a central location in Portage la Prairie, Manitoba. The builder converted the motel to housing for young, single adults with a variety of disabilities, including multiple sclerosis, muscular dystrophy, cerebral palsy, and hearing and seeing disabilities.

The 1989 conversion of the one-storey motel by the builder and the Manitoba government (in consultation with the local resident group) into Villa Royale involved gutting and reconstructing the building's interior. Only the roof, interior structural elements and exterior walls were left intact. The extensive renovation



61 Shelly, one of the residents, communicates with people by using a specially designed board that allows her to spell out words with her eyes.



62 A resident outside Villa Royale.

63 The toilet rails can be easily installed and removed.

64 Pull-out shelves and roll-out trolleys are featured in the kitchens.

resulted in two upstairs apartments for people without disabilities and eight ground-level, wheelchair-accessible apartments that are accessed by an enclosed street corridor. Communal laundry and adjacent toilet facilities are provided, as well as sleeping quarters for Homecare night staff. Each apartment is linked to the night staff by an emergency response pull-cord system, which can be activated from the bathroom, bedroom or kitchen. The apartment entrances are pre-wired to accommodate electric door openers if required.

Other features include pull-out cabinets and knee space beneath the bathroom washbasin and kitchen sink, and reinforced walls around the bathtub to allow for the installation of grab bars if necessary. A special toilet seat with portable arms is in most bathrooms.

The main entrance doors are electronically activated. One apartment entrance is monitored by video camera for an occupant with impaired hearing, while the remaining apartments are linked by intercom with the main entrance. ▲

65 The generous knee space helps people who use wheelchairs to prepare meals.

CHAPTER 5

New Integrated Housing

* * *

For new housing to blend in with the surrounding community, it must assume characteristics of the neighbouring buildings. Just as one should not build a high-rise on a street where bungalows are the norm, so too one should not construct a house whose appearance is completely out of character with those of the houses around it.

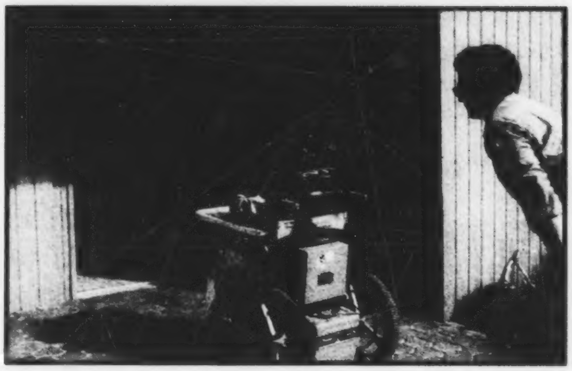
In all of the examples presented in this section — whether they be individual homes or small and large developments — great care has been taken by the architects to ensure that the buildings blend in. To the casual observer, it is not evident that such housing projects as New Zealand's safe houses, England's Lansdowne Lane housing scheme and Canada's Daly Co-operative are home to people with disabilities. A sensitive approach to good design is definitely the hallmark of the following housing schemes.

Individual Homes

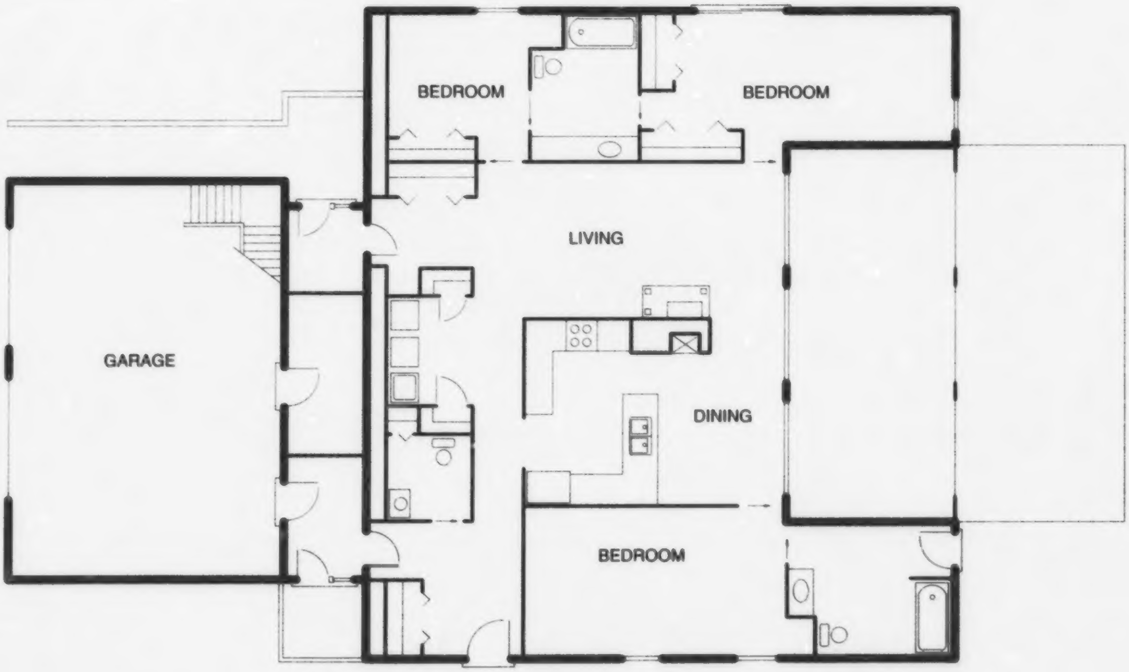
Erica's Home

The story of Erica's home, in Ottawa, is about a family that built a house to satisfy the changing needs of their youngest daughter from the time of her birth until she reaches adulthood. Erica (now a young girl) requires leg braces and crutches to get around, so the house had to be designed to provide her with continual barrier-free access as she grows up.

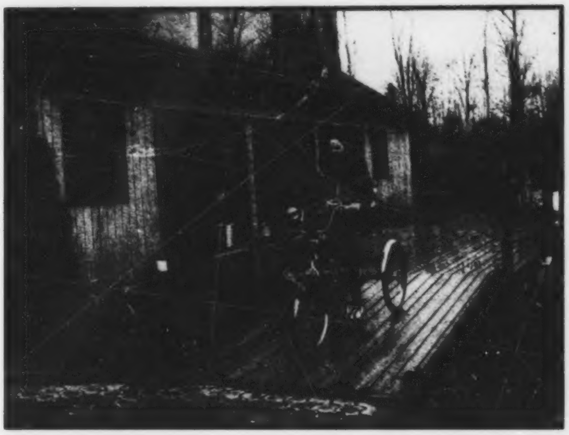
As the architect describes it, this is actually a house within a house. The double wall, or envelope, coupled with passive solar heating, make the home comfortable and energy-efficient. The bungalow is surrounded by a barrier-free walkway, which Erica uses every day. The double garage allows for easy unloading of a wheelchair from both sides of the two family cars. Within the house, the open floor plan lends an airy look to the surroundings and allows Erica to roam freely.



66 Six-year-old Erica welcomes a friend.



67 Erica's barrier-free home.



68 Erica enjoys cycling.

69 No threshold separates the deck from the house.

In and around the house, the individual fittings, even down to the clothesline, have been carefully designed with the needs of Erica and other family members in mind. Erica has her own ensuite bathroom, where the vanity is tucked under the sink and the toilet is hung from the wall for easier transfer from a wheelchair.

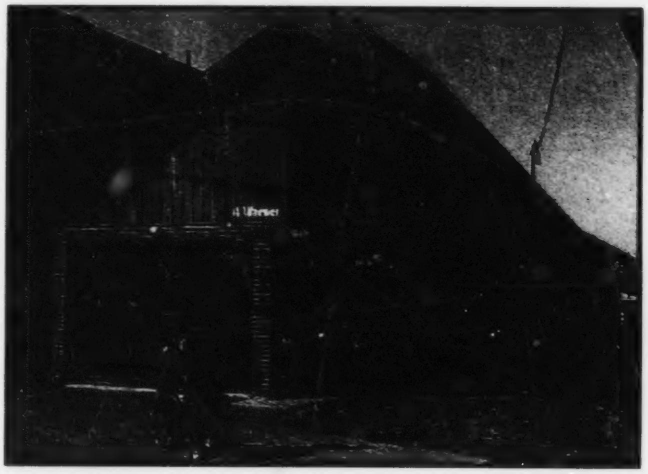
70 Erica's own bathroom.

By providing a suitable home environment, Erica's parents are helping her to enjoy an active and independent life. ▲

The Israel House

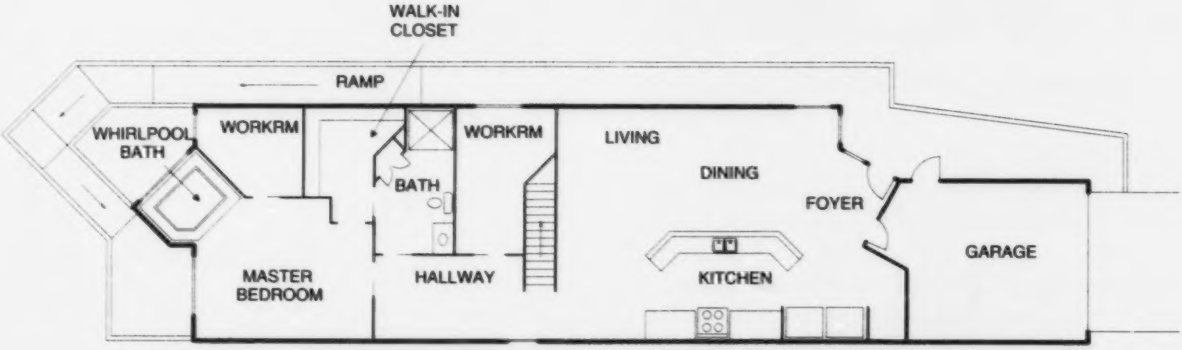
Independent living was an absolute must for the Israels, of Toronto. For the married couple, who have physical disabilities and are wheelchair users, it was vital that their home environment promote independence and reflect their tastes and personalities. Hence, the decision to custom-design their own house.

Although they decided to build on a narrow lot, the lot configuration did not impede their ability to design a house that would accommodate their particular needs. The open floor plan of their one-storey house not only fits comfortably within the lot restrictions, but also responds very well to the Israels' needs and preferences. In addition, the Israels ensured that the overall house design would fit in with the two-storey character of their



71 The Israel house.

72
This view illustrates the open design concept.


WALK-IN CLOSET
RAMP
WHIRLPOOL BATH
WORKRM
WORKRM
LIVING
DINING
BATH
FOYER
GARAGE
MASTER BEDROOM
HALLWAY
KITCHEN

73 Floor plan of the barrier-free house.

neighbourhood by increasing the height of the living/dining room through the use of a cathedral ceiling.

74 The barrier-free kitchen.

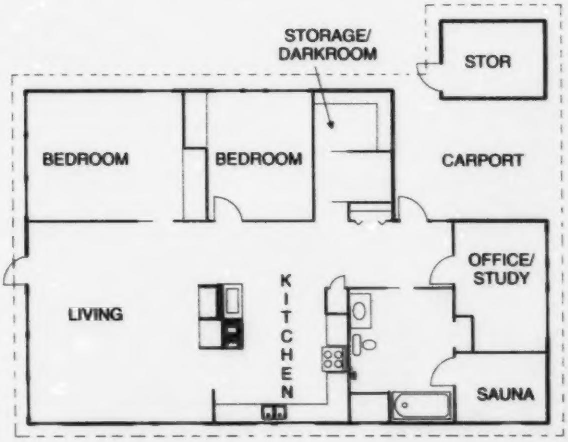
Some of the design features that exhibit the Israels' personalized response to their particular needs are the barrier-free design approach used in all rooms, including closets; lowered counters and accessible cabinets, combination microwave/convection oven and side-mounted controls on a countertop element in the kitchen; a rear deck with a ramp that can be used as a fire escape; ample space in all rooms for turning circles for wheelchairs; and a sheltered entrance. These features enhance rather than detract from the ambience of the home. ▲

The Seeman House: A Norwegian Example

In Oslo, Norway, there is a single-family house designed for one person who uses a wheelchair and another who depends on crutches to get around. It was designed by the owner, Karl Henrik Seeman, a professional architect and wheelchair user.

With financing from the Norwegian State Housing Bank, Mr. Seeman has created a modest-sized house for himself, his wife, who uses crutches, and his teenage son, who has no disability. An efficient layout with no unnecessary traffic areas or partitions makes it easy for the Seemans to move around. The materials used throughout the house were selected on the basis of their capacity to minimize maintenance and cleaning tasks.

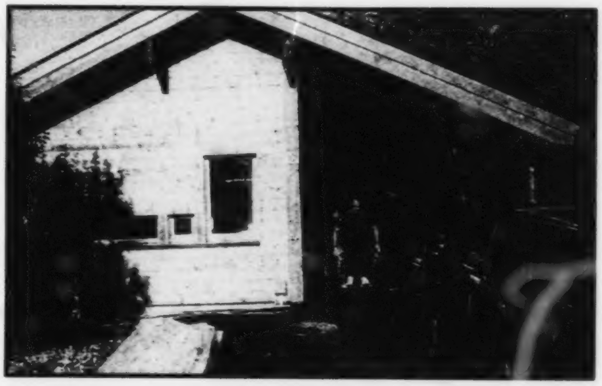
Electric heating cables are installed under all floors. They are also used under the floor in the carport and under the driveway to prevent these areas from icing up. Wooden slats on the patio floor facilitate ease of movement, and raised flower boxes, 45 centimetres from the ground, enable the Seemans to enjoy gardening.



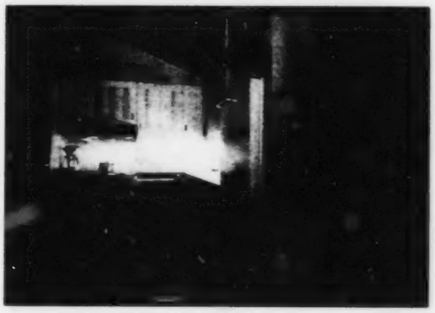
75 A two-way fireplace divides the kitchen area from the sitting area.

A House in Rural Prince Edward Island

It is often more difficult for people with disabilities living in rural areas to find suitable housing. However, a Prince Edward Island couple has demonstrated that it is possible to have a custom-designed house built to meet their requirements.



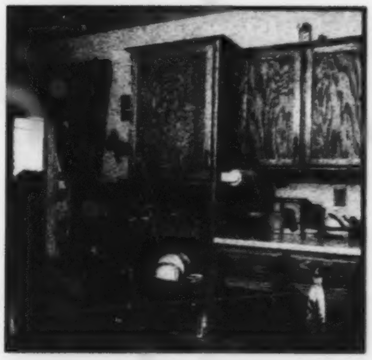
76 Mr. Seeman can drive right up to the house entranceway.



77
The kitchen.

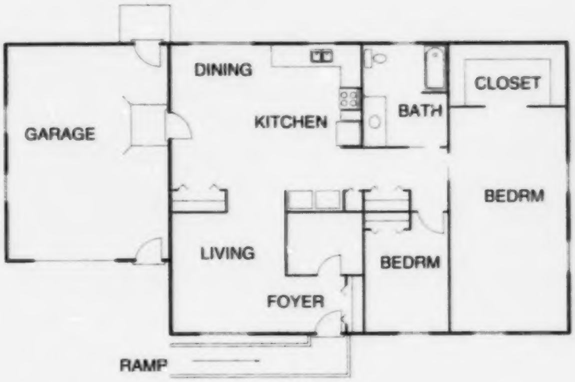
78 Wheel-in clothes closet with easy-to-reach shelving.

Other features of the Seeman house include a combined bathroom and laundry room, equipped with both bathtub and shower, and a seat that Mr. Seeman can use to slide from his wheelchair into the tub; countertops in the kitchen positioned at a height that suits both Mr. Seeman, who usually works sitting down, and his wife and son, who work standing up; knee space provided under the counters to accommodate Mr. Seeman's wheelchair; the carport with convenient pegs and shelves for storing tools, and enough room for Mr. Seeman to work on the car if he wishes; a large, two-way fireplace that divides the kitchen area from the sitting area, into which the other main rooms open. ▲



79 Pantry with pull-out racks.

80 Home in a rural setting.



81 The floor plan.

The adult couple, one a paraplegic and the other a quadriplegic, live in the rural community of Johnstons River, east of Charlottetown. Completely accessible, the house has several features worth noting. The garage can accommodate two wheelchairs, and the couple is able to get in and out of their car without any help. In the kitchen, the pantry shelves are on rollers; in the bedroom, the closet is large and accessible by wheelchair. Windows have been lowered for easy viewing from chairs, and non-glare flooring and contrasting colours have been used throughout the house. ▲

The New Zealand Safe House

Claims to the New Zealand Accident Compensation Corporation resulting from home accidents totalled 31 446 in 1990 — almost as many as those resulting from road and sport accidents. The main causes of accidents in the home are straining, reaching and overbalancing; a substantial number also result from tripping and stumbling. Falls in the bathroom by seniors and back injuries are also quite common.

82 The front entrance.

It is obvious that everyone can benefit from living in a safer home. As part of its barrier-free program, the Government of New Zealand launched a Safe House design campaign in 1986. A major objective of the Safe House design concept is to link design and health considerations to create housing that is intrinsically safe and accessible.

To be intrinsically safe and accessible, housing must reflect the principles of safe, accessible design and universality. The purpose of the first principle is to create housing that promotes and supports lifelong physical independence and minimizes the likelihood of unintentional personal injury. Basic security and fire protection measures are also reflected in the design of a Safe House. The principle of universality aims to produce housing that is usable by and convenient for everyone,

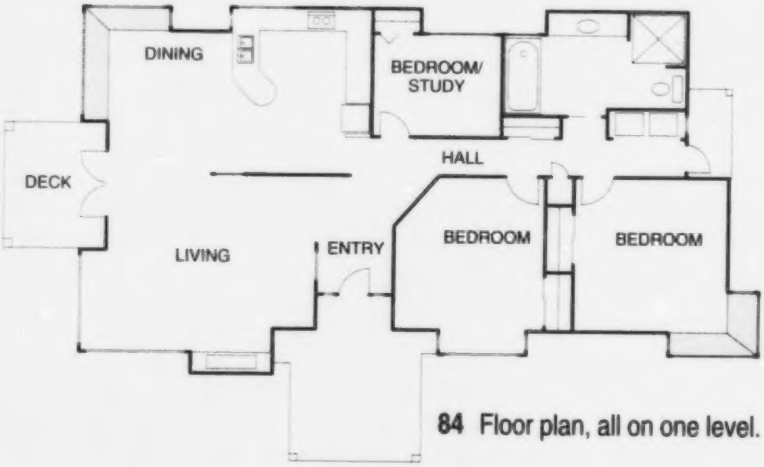
83 The deck, which is level with the living/dining room floor.

including families with children, seniors and people with disabilities. Although a dwelling may not be specifically intended for occupation by members of these groups, it is assumed that during the lifespan of the dwelling someone from one or another of these groups may live in, or visit, that dwelling.

Following the 1986 Safe House campaign and the Safe House demonstration homes at the annual Aukland Home Show, several private companies began to market the Safe House principles as part of their design services. The New Zealand Safe House, developed by a private builder working in collaboration with a design consultant who specializes in barrier-free and safe environments, is designed to meet the requirements of the *Code of Practice for Safer House Design*. This code was published in 1990 by the Standards Association of New Zealand.

The design features of the New Zealand Safe House include a wet-area shower, where the floor of the shower area is continuous with the rest of the bathroom floor; non-slip flooring and no steps; wide doorways, easily-operated door hardware and generously open circulation spaces; rounded edges on work surfaces and no through-traffic in the work area of the kitchen; controlled hot water temperatures and easily-operated taps and mixing valves; childproof electrical outlets located to reduce the need for bending by adults; and fire and security features, such as smoke detectors, fire extinguishers, intruder alarm, deadlocks and security hardware, exterior dazzle lighting, and panic lighting.

A Safe House design takes into account the different physical needs and capabilities of an entire population, not just the 25 percent who might be fit and agile. ▲



84 Floor plan, all on one level.

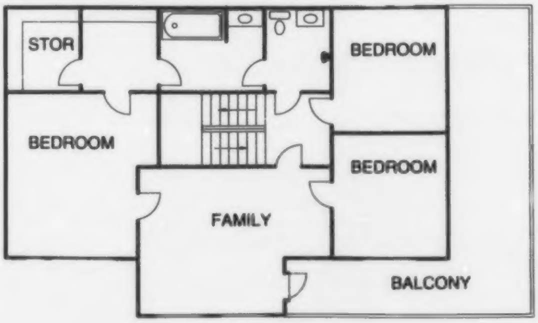
The Fladager House: An Example of Lifespan Housing in Norway

To improve accessibility in housing for all members of the population, the Norwegian Association of the Handicapped developed the lifespan dwelling design concept in 1981. Implementation of this concept was intended to enable many people with disabilities to live more independently at home and integrate increasingly with the rest of the population. It was thought that this could result in reduced demand for help from relatives and government, as well as reduced demand for institutions and other forms of special needs dwellings.

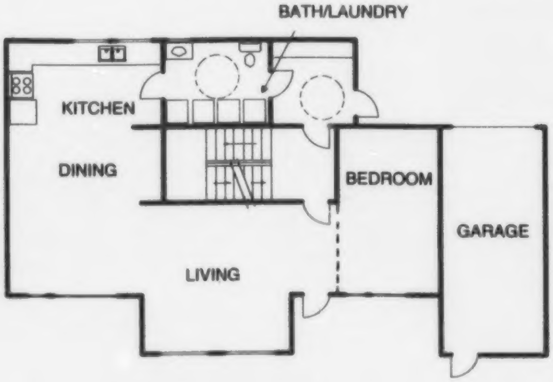
To be considered as a lifespan house, the ground floor of a two-storey building must contain the living and dining rooms, kitchen, one bedroom and a bathroom. Considered to be essential, these rooms must be completely accessible to a person using a manually operated wheelchair. Such a person must also be able to access the main entrance of the house from the parking area and carry out, as independently as possible, all the major activities involved in daily living: going to bed, bathing and personal hygiene, using the toilet, preparing meals, and so on. Indeed, the ground floor of the lifespan house can function as a completely accessible, one-bedroom, self-contained dwelling. For a family with children, the remaining rooms can be located on the second floor.

85 The Fladager house.

The open plan ground floor of the house designed for the Fladager family, who live near Oslo, conforms to the lifespan standard. The



86 The second floor serves the needs of the family's children.



87 The open plan of the ground floor keeps circulation space to a minimum and allows for the creation of a bedroom, if required.

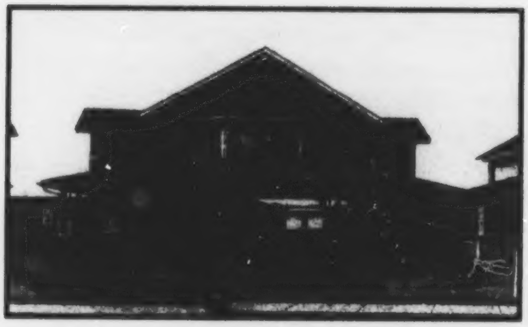
Fladagers want the house to function for all age groups and varying stages of family life. Thus, the upper floor, with its three bedrooms and living area, can be used as the children's play area or for socializing when the children become teenagers. The main floor can be left free for the older generation and can even function as a self-contained dwelling unit that is easily adaptable to the changing needs of elderly people. Because the balcony from the upper-floor living room extends to the carport roof, the second floor can easily be converted into another self-contained unit. Flexibility such as this is another common feature of the lifespan house concept.

The increasing availability of lifespan housing in Norway is in part a result of the subsidized loans (loans with preferred financing) that are being offered by the Norwegian State Housing Bank. Today, over 33 percent of all dwellings financed through the state bank are lifespan dwellings. It is estimated that about 15 percent of all new dwellings in Norway meet the lifespan standard. ▲

Two- and One-Storey Semi-Detached Homes in Thunder Bay, Ontario

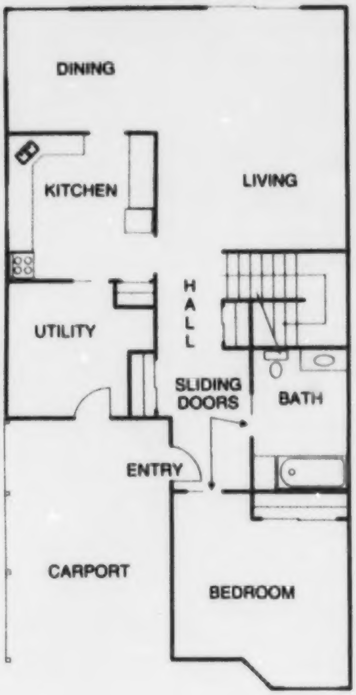
The Thunder Bay Non-Profit Housing Corporation's approach to accommodating the housing needs of persons with disabilities has been to construct one- and two-storey semi-detached homes that are fully integrated with the rest of the homes in the community.

In the 46-unit Picton-Tamarack housing development, occupied by low-income families, 10 of the units are designed to accommodate families with one or more persons with disabilities. These units are paired in five buildings; two buildings contain two one-storey units each, while the other three buildings

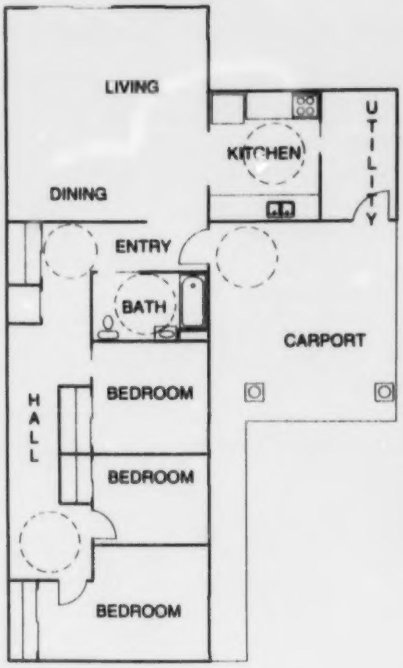


88 Semi-detached two-storey houses.

89 Semi-detached one-storey houses.


DINING
KITCHEN
LIVING
UTILITY
HALL
SLIDING DOORS
BATH
ENTRY
CARPORT
BEDROOM

90 Ground floor plan: two-storey semi-detached house.


LIVING
KITCHEN
UTILITY
DINING
ENTRY
BATH
CARPORT
HALL
BEDROOM
BEDROOM
BEDROOM

91 Floor plan: one-storey semi-detached house.

92 Sliding pocket-doors allow for better use of space and enhance accessibility.

contain two two-storey units each. Input into the design of these units was provided by Handicapped Action Group Inc.

As in the Norwegian lifespan house, the ground floor of the two-storey units contains all the essential rooms of a self-contained dwelling, including a bedroom and a complete bathroom. The ground floor of the two-storey unit and the entire one-storey unit are completely accessible to a person using a wheelchair. Design features include: in the kitchen, tabletop stoves with front controls, ovens set in cabinets and countertops positioned at a height 5 centimetres lower than the standard height (to allow both a person using a wheelchair and a person standing up to work at the counter in reasonable comfort); and in the bathrooms, lower sinks, sliding pocket-doors and grab bars. The ground-floor bedroom in the two-storey unit also has sliding pocket-doors.

A carport has been provided for each of the 10 units designed for persons with disabilities to allow a wheelchair user to access the home and vehicle in comfort during inclement weather. ▲

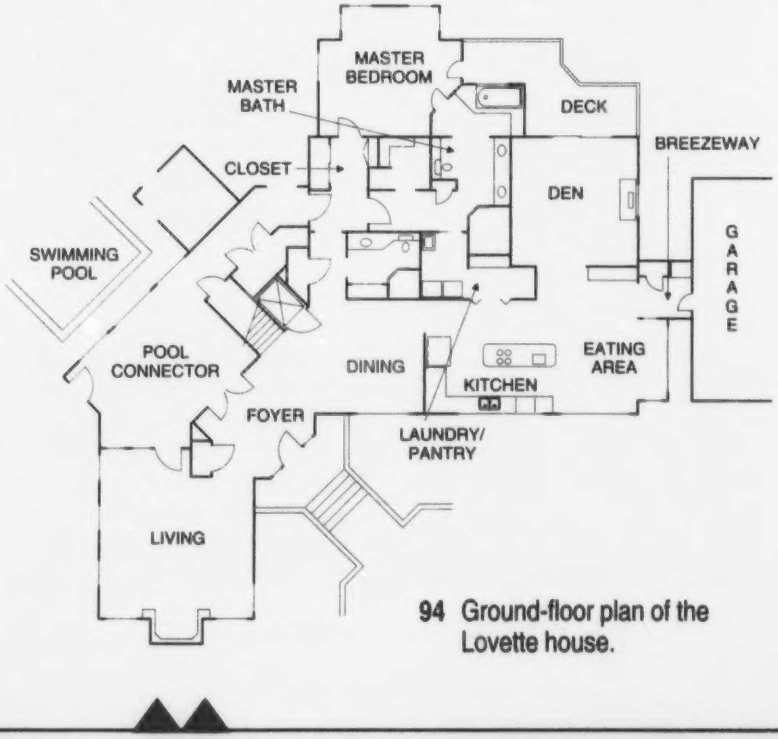
The Lovette and Kelly Homes: Two United States Examples

U.S.-based Barrier-Free Environments Inc. custom-designs houses for people with disabilities; but underlying its work is a desire to create universally acceptable dwellings rather than special houses for a specific group of people. By integrating essential design features that work for everyone, the company is able to produce houses that are more flexible, more accessible and more widely acceptable in the marketplace. The Lovette and Kelly homes are examples of houses that truly offer lifetime accessibility.

The Lovette House

The Lovette house suits the needs of its middle-aged owners, one of whom uses a wheelchair. Design features include pull-out shelves and a trolley in the kitchen; a skylight that can be easily

93 The bridged front entrance.


MASTER BEDROOM
MASTER BATH
DECK
BREEZEWAY
CLOSET
DEN
SWIMMING POOL
GARAGE
POOL CONNECTOR
DINING
EATING AREA
KITCHEN
FOYER
LAUNDRY/ PANTRY
LIVING

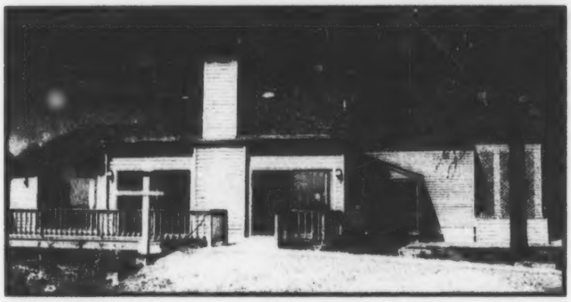
94 Ground-floor plan of the Lovette house.

95 Pull-out trolley in the kitchen.

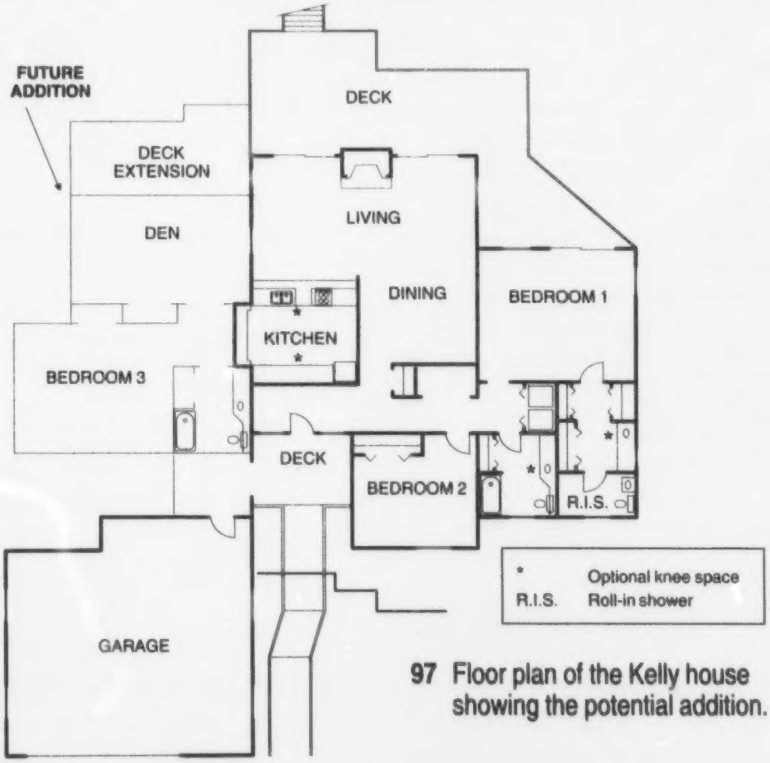
opened with a special pole, reinforced walls with grab bars and a roll-in shower in the bathroom; a bridged front porch and a ramped sundeck; a fireplace hearth level with the floor; and an elevator that provides easy access to the second floor.

The Kelly House

The Kelly house is designed to accommodate an addition whenever the owner, a single paraplegic living alone and who uses a wheelchair, requires a live-in attendant, or his mother finds she can no longer live on her own.



96 The rear deck.


FUTURE ADDITION
DECK
DECK EXTENSION
LIVING
DEN
DINING
BEDROOM 1
KITCHEN
BEDROOM 3
DECK
BEDROOM 2
R.I.S.
GARAGE
* Optional knee space
R.I.S. Roll-in shower

97 Floor plan of the Kelly house showing the potential addition.

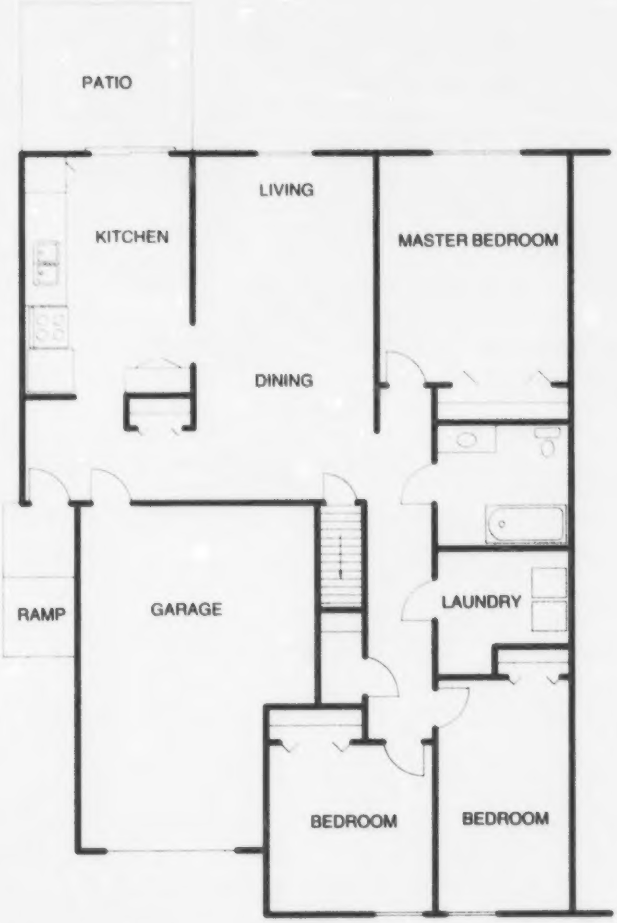
98 The kitchen sink.

Street Housing in Oakville, Ontario

In what is truly street housing, Interfaith Homes Corporation has built 50 homes in one townhouse project and 26 in another in Oakville, Ontario. All the houses front onto a municipal street and are designed and constructed to match closely the appearance of the other houses in the neighbourhood.

The space could also be rented out as an accessory unit.

For improved safety, the master bedroom has direct access to the outside. The garage, on the same level as the house, is accessed by a sheltered pathway; and the bathroom of the master bedroom features a unique wheel-in shower area. ▲


PATIO
LIVING
KITCHEN
MASTER BEDROOM
DINING
RAMP
GARAGE
LAUNDRY
BEDROOM
BEDROOM

99 Floor plan of the three-bedroom homes.

100 One-storey semi-detached dwellings for people with disabilities

Five one-storey homes have been earmarked for people with some type of physical disability. Each of these houses features an extra large garage for easy wheelchair access directly into the house; a laundry room on the main floor; wheelchair-accessible closets; a kitchen pantry with roll-out shelves and drawers, and a sink with knee space underneath; lower light switches, thermostat and electrical controls; lever-type door hardware; and, in the bathroom, a washbasin with knee space underneath, and grab bars and a sitting area to enable people to get in and out of the tub more easily. The basement stairs are designed to facilitate future installation of a chair lift. Sliding patio doors lead to a pleasant backyard deck with a ramp down to the garden. ▲

Small Developments

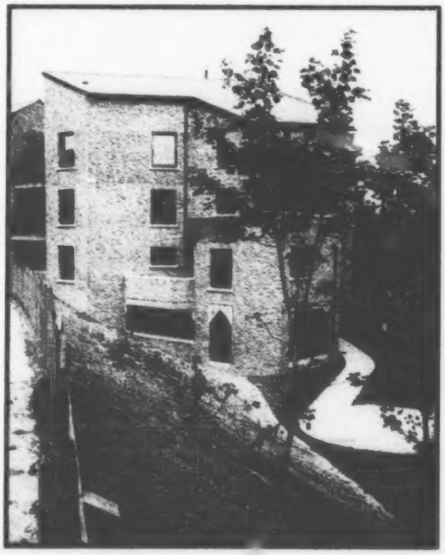
Many people dislike the idea of living in large-scale housing developments. Small-scale developments may provide the best type of housing for the particular needs and preferences of these people.

This section features several small developments, including Lansdowne Lane in England, a seniors' housing development in Nova Scotia, the Rotary Cheshire apartments in Ontario, the Satellite Village in Australia and the Noble Housing Co-operative in British Columbia. Each has its particular strengths and attractions.

Lansdowne Lane in England

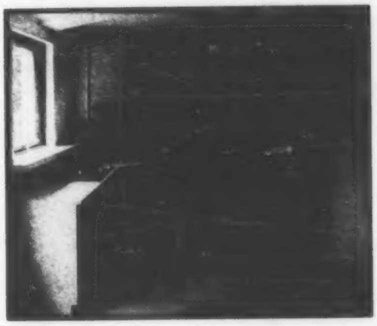
This 16-unit housing scheme in London, England, successfully demonstrates that housing can be provided for people with disabilities in a building that also provides housing for other people. All the units in the three-storey building are wheelchair-accessible, but only the six units situated on the ground floor are actually designated for people who use wheelchairs.

Built by the Hyde Housing Association, the building and individual units were designed in association with the Greenwich Association of Disabled Persons, the London Borough of Greenwich Special Housing Unit and several occupational therapists. The complex is shaped like a tadpole to conform to the shape of the lot. A five-metre drop across the site made it possible for the architect to introduce a parking area under the building; wheelchair users and



101 The drop across the site allowed the architect to introduce a fully accessible parking garage under the building.

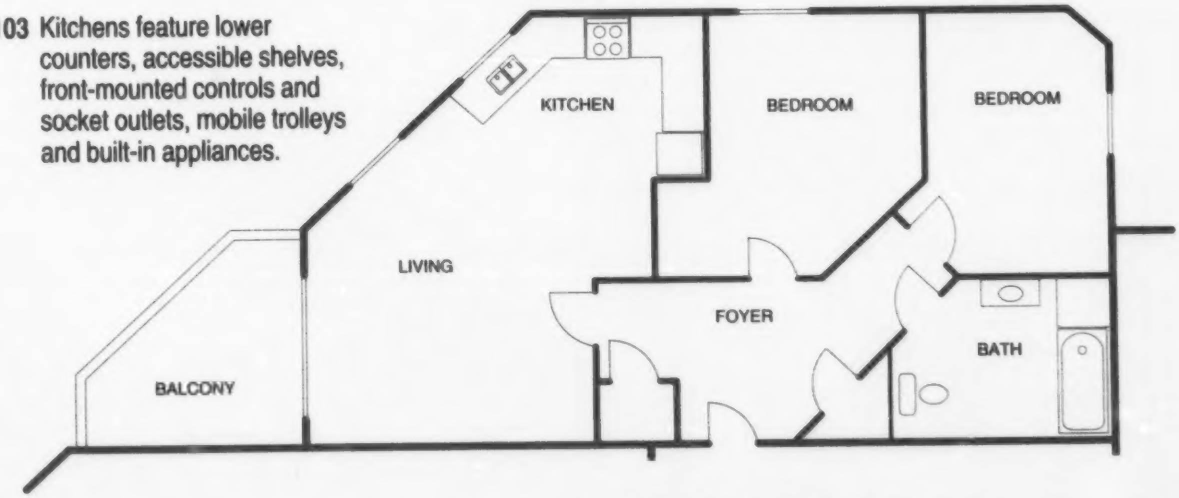
102 A typical dwelling entrance with delivery shelf, peep-window and no threshold.



103 Kitchens feature lower counters, accessible shelves, front-mounted controls and socket outlets, mobile trolleys and built-in appliances.

pedestrians can go from the garage to the upper levels via an elevator. Recharging facilities for electric wheelchairs are also provided in the garage. The units, with balconies on the east or west sides, are juxtaposed, thus encouraging resident interaction yet affording each resident a great deal of privacy.

Residents can open the main entrance and garage doors by radio, card key, entry phone, or a combination of these methods. In the units themselves, delivery shelves that are accessible to people in wheelchairs are provided at the main door, the kitchens feature 850 millimetre-high counters and accessible shelves, front-mounted controls and socket outlets, mobile trolleys and built-in appliances. In the bathroom, the entire watertight floor area slopes to a floor drain, which can be used in the future for converting the original bathtub into a fully accessible shower area. ▲



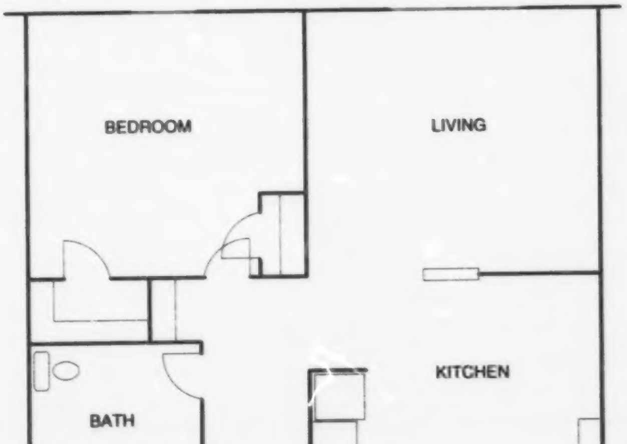
104 One of the units for a wheelchair user.

Accommodation Within Seniors' Developments: An Example in Nova Scotia

The Non-Profit Housing Program in Canada provides assistance for the construction of new housing or the acquisition of existing housing by non-profit groups and municipal and provincial housing agencies. Under this program, housing for persons with disabilities is provided in two ways: through projects developed exclusively for persons with disabilities and through guidelines that at least five percent of the units in housing projects should be "mobility" units. A recent survey indicates that, in fact, 14 percent of all non-profit housing units produced in Canada between 1986 and 1990 meet at least the basic "mobility" unit standard.

This 10-unit seniors' apartment building, located in the rural community of Hantsport, in Nova Scotia's Annapolis Valley, is an example of a small, non-profit housing project. All the communal rooms and areas in the building are wheelchair-accessible. One of the one-bedroom units has been designed to accommodate a person who has difficulty walking and uses a wheelchair. Design features of this unit include good circulation patterns and provisions for wheelchair turning; a pantry with adjustable shelves and a wall oven in the kitchen; a shower stall with a built-in bath seat in the bathroom; and clear space under the kitchen sink and bathroom washbasin to allow access for a wheelchair. ▲

105 Seniors' apartment building in Hantsport.



106
Dwelling unit designed for a person who has difficulty walking.

Rotary Cheshire Apartments for Deaf-Blind Adults

The Rotary Cheshire Apartments in Toronto, Ontario, provide an opportunity for adults who are both deaf and blind to live independently in the community. Because the building is free of communication barriers, residents of the 16 one-bedroom units are able to concentrate on enhancing their abilities and pursuing individual goals.

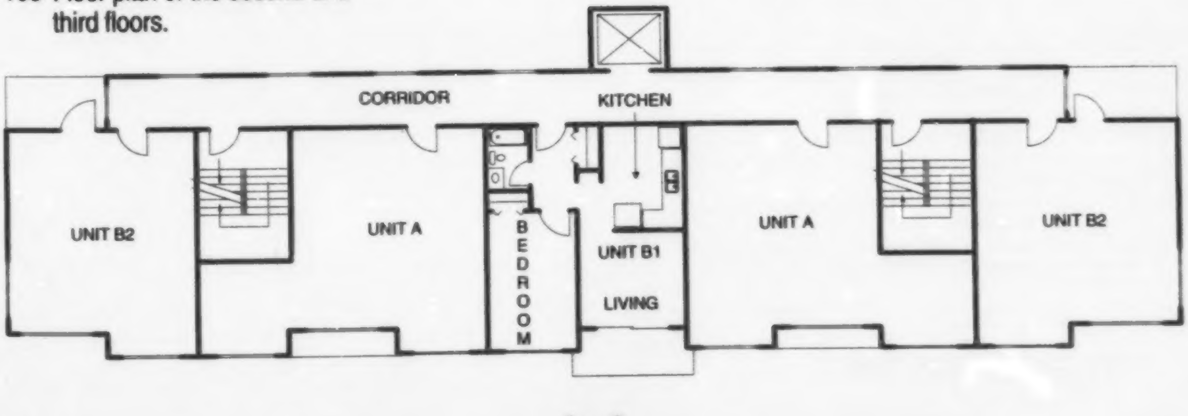
107 A view from the street.

The first of its kind in North America, the building is complete with innovative devices, aids and technologies that help to enhance the independence of its residents. Television readers, braillers, closed-caption TV decoders, special typewriters and computers, braille books, strobe fire alarms, even tactile markings on elevators, doors and the edges of steps and landings are some of the more interesting features.

In terms of design, the architect made the corridors wide enough to accommodate the side-by-side passage of two people using canes. Bright, non-glare lighting (for residents with light-sensitive vision), large mailboxes for braille books and letters that cannot be folded, anti-static carpeting and humidity controls (to keep hearing aids from malfunctioning), and spacious closets to allow for clothes separation and organization indicate the thought and sensitivity that went into the design of the project.

Other innovative features of the project include tactile surfaces on the rear path that alert the user to areas which are for resting and those that might be unsafe; other special surfaces on the pathways around the building that alert the blind-deaf resident to driveways and entrances; doors, including those on elevators, painted in colours that contrast with the walls to aid those with partial vision; prominent colouration for

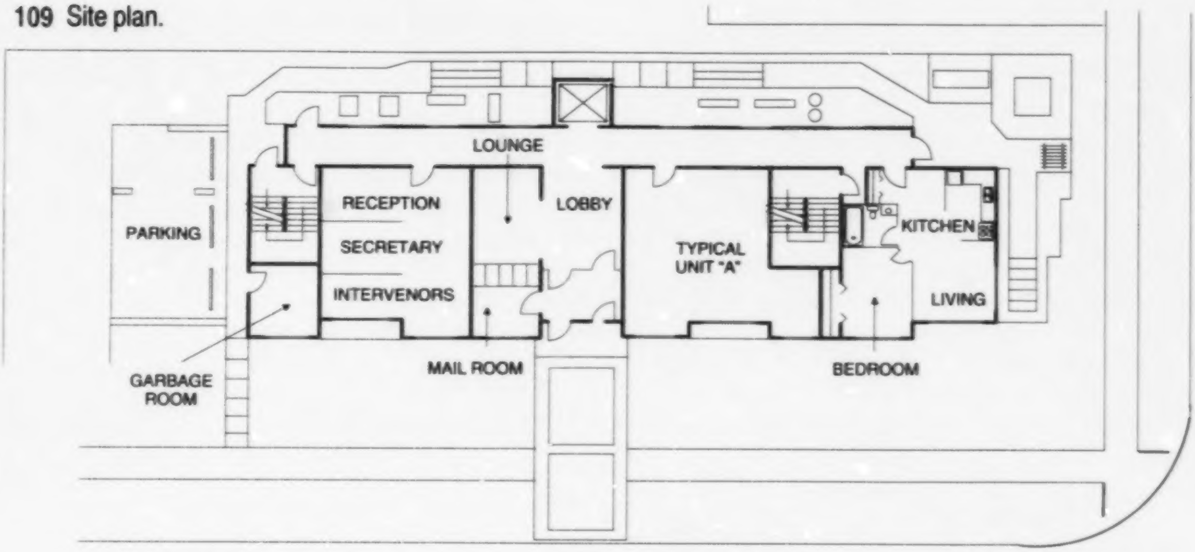
108 Floor plan of the second and third floors.

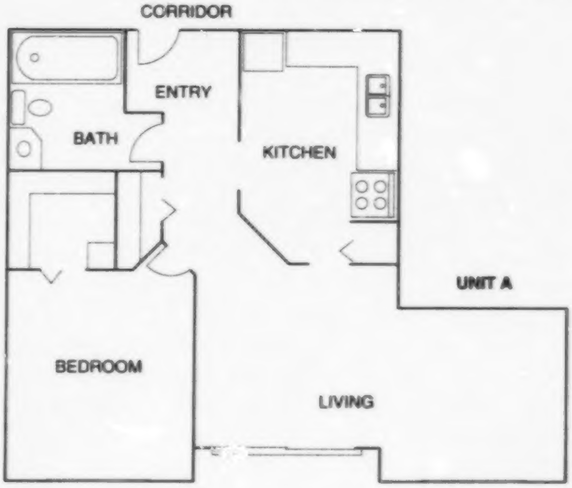


the ground floor to assist partially-blind residents; ground-floor door openings made level with the outdoors; windows along the corridors spaced to provide a reference for those sensitive to light and located in such a way as to maximize the light; translucent windows equipped with adjustable blinds; carpet covering on all obstacles, including the columns in the multi-purpose room; and an entry phone and a telebraille unit in the front vestibule, to allow a deaf-blind person to "talk" to a resident without the aid of the building staff.

In addition to these very concrete aids and design considerations, the 16 deaf-blind residents can communicate with one another better and can access activities, thanks to a provincially funded service called Intervention. Twenty-four hours a day, an intervenor provides information in a tactile or manual communication mode. ▲

109 Site plan.


LOUNGE
RECEPTION
SECRETARY
INTERVENORS
LOBBY
TYPICAL UNIT "A"
KITCHEN
LIVING
PARKING
GARBAGE ROOM
MAIL ROOM
BEDROOM

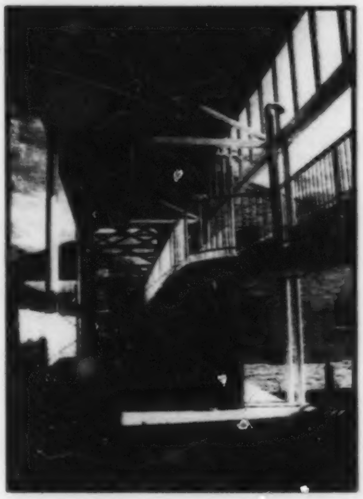

CORRIDOR
ENTRY
BATH
KITCHEN
UNIT A
BEDROOM
LIVING

Design features include:
- Living room lights on dimmer switches.
- Brightly coloured electrical outlets and switches.
- Valance lighting under kitchen cupboards.
- Loop handles on all cabinets.
- Open concept apartment layout for easy mobility of occupants.
- A fire alarm horn and a strobe light in each room, activated by the building fire alarm.
- A strobe light in living room and bedroom, activated by the apartment's smoke alarm.
- Suite smoke alarm, building fire alarm, entry phone system and telephone connected electronically to wrist vibrators worn by residents.

110 Floor plan of a typical dwelling.

Australia's Satellite Village

The Vasey Housing Association's satellite village in suburban Sydney, Australia, is clustered on a narrow piece of land; 13 one-bedroom units share a central garden courtyard, which has a fountain and sitting area. This village houses widows of defence personnel and retired female defence personnel. Anticipating that the degree of mobility of residents will decrease as they get older, the Association has incorporated passive design elements and features into the design (no mechanical devices or special equipment are provided) that provide for complete wheelchair accessibility throughout the village.



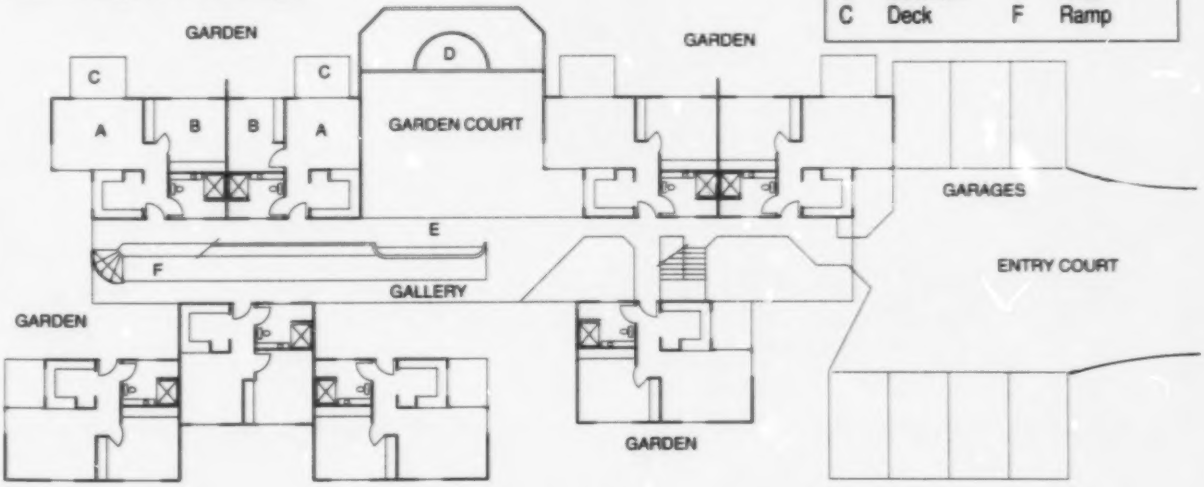
111 The glazed gallery.

Eight of the units are on the ground floor. Access to the entrance doors of the five units on the second floor is via either a ramp, built at a grade of 1:14, or a flight of stairs. A roofed and glazed gallery provides protection when the residents venture out in inclement weather. In addition, each unit on the ground floor has its own private garden, while the second-floor units have generous sized balconies.

Typical of the satellite village concept, the residents have access to homecare services provided by travelling staff of the Association. Services include an emergency response system, housekeeping and laundry, meals, and personal care on an assessed needs basis. ▲

112 The layout of the village.

A	Living	D	Fountain
B	Bedroom	E	Seat
C	Deck	F	Ramp



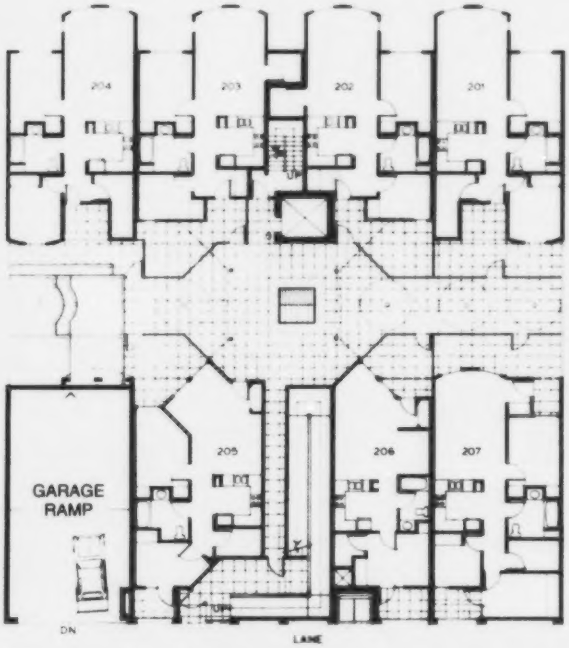
The Noble Housing Co-operative

One of the best examples in Canada of a housing development that incorporates many new design concepts and technolgies, including intelligent building technologies, adaptable kitchens and bathrooms, and barrier-free design for persons with a variety of disabilities, the Noble Housing Co-operative, in Vancouver, British Columbia, was designed with maximum input from people with disabilities. The clients, consultants and architect actively participated in arriving at a solution that would promote and support as much physical independence as possible for its residents.

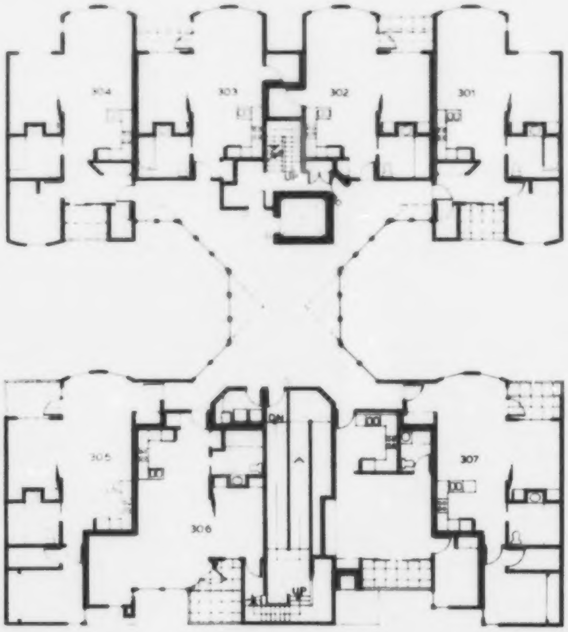
The 21-suite, four-storey infill housing project is home to adults with a range of needs and preferences. The entire building is designed to be barrier-free for all of its residents: grade changes are minimized, doors are wide, rooms are big enough, and fixtures and controls are within reach. The building also has an electronic system designed to maximize the independence of quadriplegic residents, with features such as remote controls for the elevator and 14 doors throughout the building.

113 A view from the street.

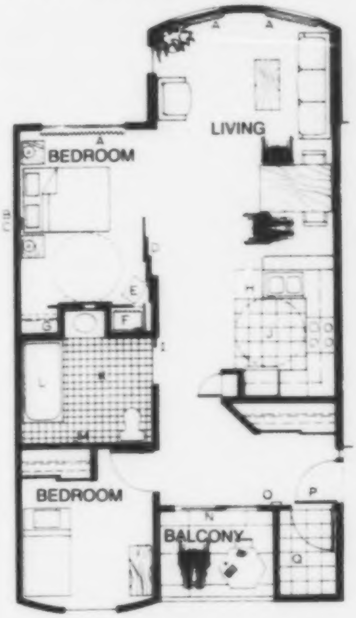
A total of 14 adaptable suites on the second and fourth floors allow for wheelchair accessibility



114 Second floor: adaptable suites.



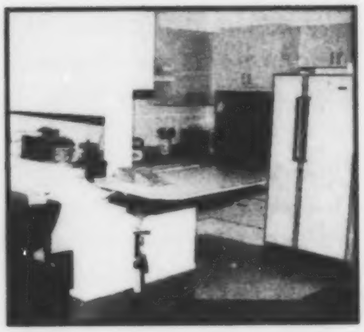
115 Third floor: suites for people who use respirators.



116 A third-floor suite.

A	Motorized Louver Blinds
B	Intercom
C	Microphone Switch
D	Moveable Panel Wall
E	T.V. Ceiling Mounted
F	Environmental Control Unit
G	Double Height Rod and Shelf
H	Tilt-up Counter Top
I	1.06 m Wide Pocket Door
J	Accessible Kitchen
K	Accessible Bathroom
L	1.8 m Long Raised Tub
M	Emergency Call Button
N	No Threshold
O	Alarm Indicator Panel
P	Power Door Opener
Q	Chair Recharging Area

117 A resident using the tilt-up countertop.



118 The kitchen in a third-floor suite.

while maintaining conventional appeal. Each suite has been custom-designed to meet its occupant's needs. Design features in the kitchen include: 0.8 metres high countertops, knee space under the stovetop and sink, side-by-side refrigerator and freezer, lazy susan, lowered cupboards and a pantry with adjustable shelves.

On the third floor are seven suites for people who use a respirator. These suites also feature bathrooms with pocket doors 1.06 metres wide, heat-restricting valves, respirator shelf and emergency call buttons; and a moveable wall, environment controls, and double rod and shelf coat closets in the bedroom. Occupants are provided with a variety of electronic equipment and controls, which are identified on the floor plan (see drawing **116**).

Because it is a self-managed co-operative, residents play a significant role in its management. Even the seven residents with severe disabilities take full responsibility for their living arrangements, including contracting for attendant care services and, as active members, participating fully in the running of the co-op and performing a variety of duties. ▲

Large Developments

Large developments do not have to be impersonal and overpowering, and they often offer a wider range of facilities, services and activities than are possible in small developments. The following examples of large housing developments indicate that tremendous insight and sensitivity have gone into making the houses attractive and useful for a variety of users, including people with disabilities.

Two Housing Schemes by Habinteg: Examples in the United Kingdom

A registered charity and specialized housing association, Habinteg Housing Association builds and promotes housing in the United Kingdom that enables people with disabilities to live independently in an ordinary setting. Habinteg believes that people with disabilities and their families should be free to choose the services they use.

Through its many projects, Habinteg has shown that persons who depend on wheelchairs for mobility or who have other mobility limitations can live independently if their homes have been carefully designed and the outside environment is accessible. On-site management and 24-hour emergency assistance are also important features of a successful housing scheme that serves to integrate everyone.

One quarter of the dwellings in Habinteg projects are designed to full wheelchair standard. Because they range from one to four bedrooms, the Association can accommodate single people, families with members who are disabled and groups of individuals who wish to share. These wheelchair units are scattered throughout the project to facilitate integration.

The other units in a typical Habinteg housing scheme, for people without disabilities, are designed to mobility standards, with wider doorways and level access, to enable wheelchair users to visit their neighbours and friends. The accessibility of these mobility units benefits everyone living there, particularly families with young children and seniors if and when they become frail.

Another feature of a Habinteg project is the flexible design approach. Bathroom and kitchen adjustments can be made easily to suit the specific needs of residents in the units intended for wheelchair users. The height of countertops, sinks, stove and storage units can be changed, and showers can be provided instead of bathtubs, where preferred. Switches and handles are located and specialized fittings such as hoists and grabrails are installed to suit individual requirements.

A community assistant, who is also a Habinteg staff member, lives in the housing development in a house linked through an emergency two-way speech call system to tenants who are elderly or have disabilities. As the project manager, this assistant arranges for repairs, handles emergency situations and works with the tenants' group and housing staff. Links are set up with local voluntary and municipal agencies and services for tenants who need nursing or home help assistance.

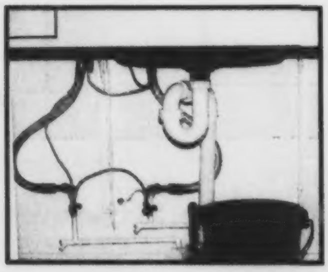
There are about 50 Habinteg housing schemes in England and Northern Ireland. The following two examples are admirable testaments to Habinteg's approach to housing.

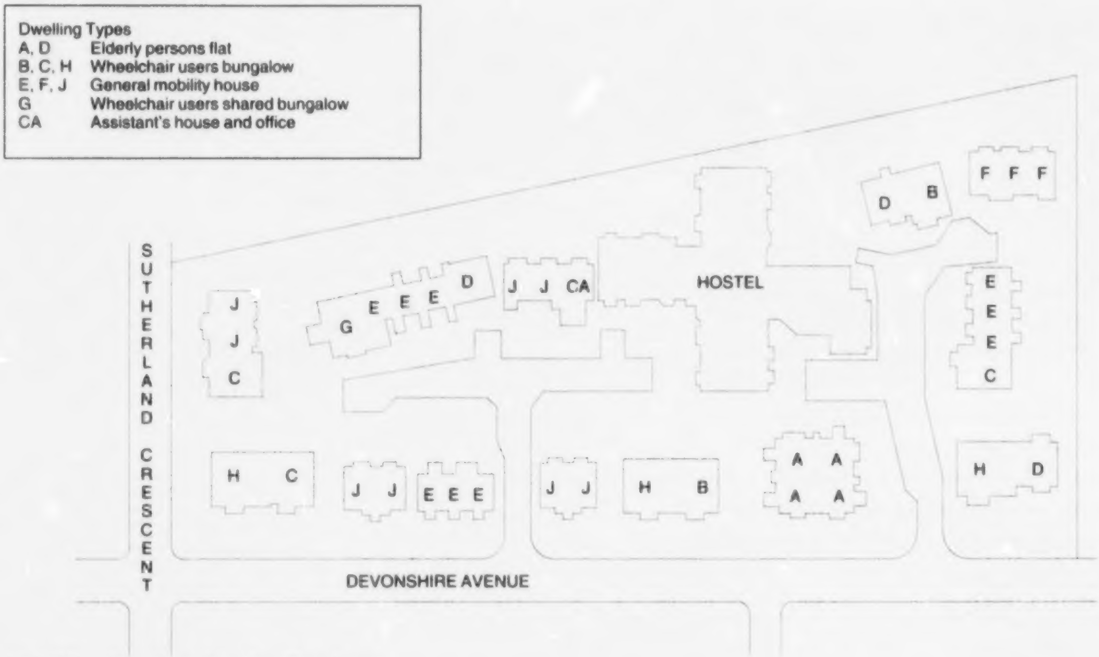
Housing Scheme in Roundhay, Leeds, England

The Devonshire Avenue housing scheme, in Roundhay, consists of 41 homes, including eight bungalows designed and equipped for families with members who use a wheelchair. Another wheelchair-user bungalow is designed for single people with disabilities who wish to share accommodation (this bungalow is described in the chapter on "Shared Housing", page 100). Eight apartments have been designated for seniors; the remaining homes are general mobility houses. The municipality is developing a hostel for people with disabilities on an adjoining site, and Habinteg's tenants will be able to use the community room in the hostel.

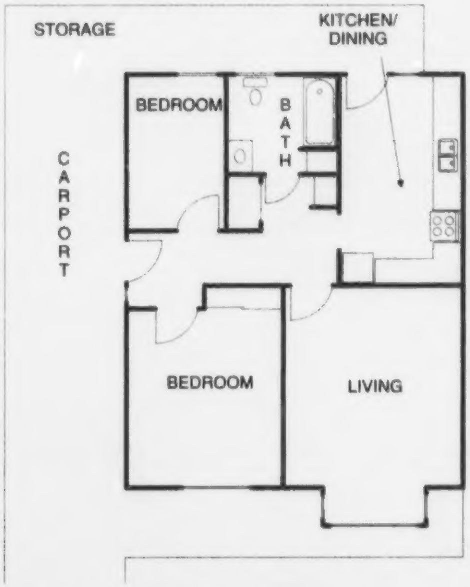
119 The hostel and a mix of dwellings.

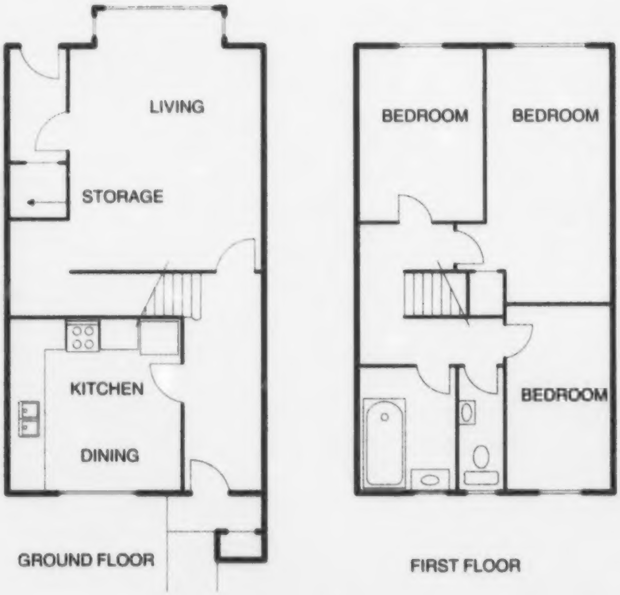
120 Flexible piping allows the sink to be raised or lowered.




Dwelling Types
A, D Elderly persons flat
B, C, H Wheelchair users bungalow
E, F, J General mobility house
G Wheelchair users shared bungalow
CA Assistant's house and office
SUTHERLAND CRESCENT
DEVONSHIRE AVENUE
HOSTEL
J J C
G E E E D
J J CA
D B
F F F
E E E C
H C
J J
E E E
J J
H B
A A A A
H D

121 Site plan showing dwelling types.


STORAGE
KITCHEN/ DINING
BEDROOM
BATH
CARPORT
BEDROOM
LIVING

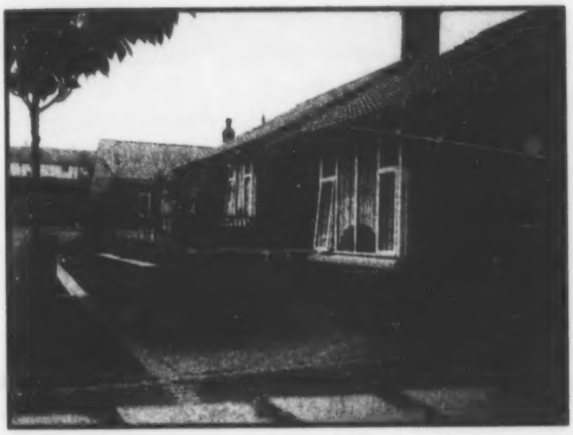

LIVING
STORAGE
KITCHEN
DINING
GROUND FLOOR
BEDROOM
BEDROOM
BEDROOM
FIRST FLOOR

122 Bungalow for wheelchair users.

123 General mobility house.

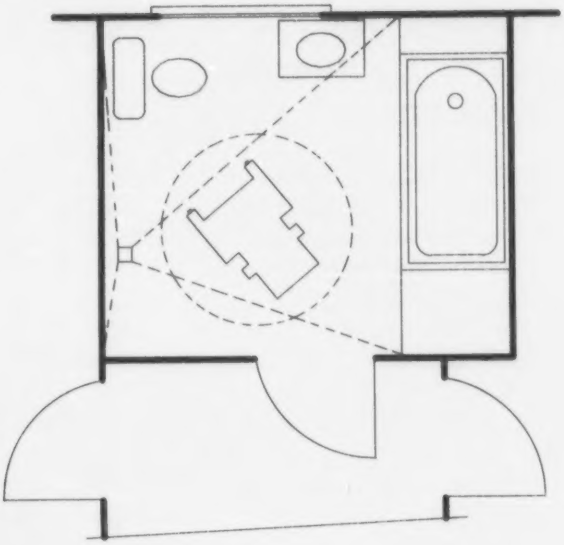
Inch View Housing Scheme in Londonderry, Northern Ireland

Habinteg's sister organization, in Ulster, Northern Ireland, operates on the same philosophy: to incorporate design flexibility into its housing projects so that people with a variety of needs and preferences can be accommodated. In the Inch View housing scheme in Londonderry, internal streets are completely accessible to persons using a wheelchair. In the units themselves, bathrooms have level-deck accessible showers, and adjustable fittings in both kitchens and bathrooms can be arranged to suit individual tenants. ▲



124 Barrier-free streets and paths.

125 Countertops and cabinets on adjustable brackets.



126 Level-deck access shower.

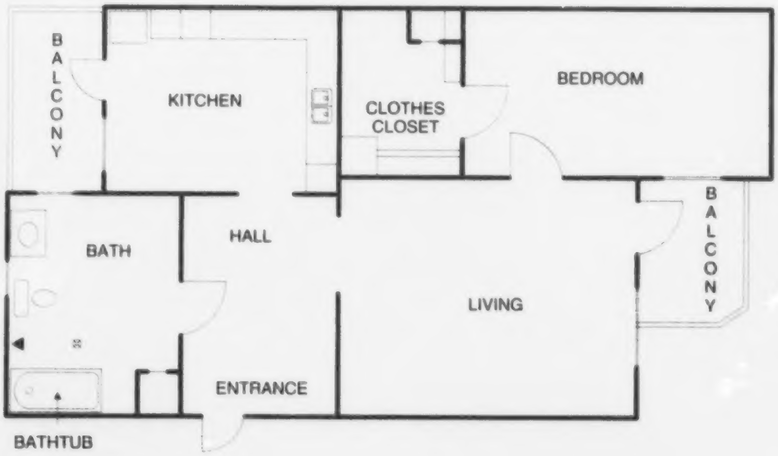
Specially Designed Dwellings in Ordinary Housing Developments in Sweden

Sweden's building regulations concerning accessibility for people with disabilities are among the most far-reaching in the world. Thanks to these provisions, which were first established in 1966 and improved in 1977, nearly all people with disabilities can live in slightly adapted ordinary housing. However, this is not usually possible for people with severe disabilities, for whom specially designed dwellings are provided. These dwellings are integrated with ordinary housing, and varying numbers (from a few up to 20) may be scattered throughout a housing development. The main entrances and common areas of multiple-unit buildings, which include these specially designed dwelling units, are accessible to people using a wheelchair.

The specially designed dwellings (also known as "housing with day and night services for severely disabled people") are generally more spacious and have larger bathrooms and kitchens than ordinary dwellings. They also feature adjustable-height countertops, which are sometimes motorized, and grab bars and other special equipment in bathrooms and kitchens; shower areas with no thresholds in the bathrooms; and clothes closets with variable-height rods.

People occupying these units receive home support services and attendant care services as needed. An emergency response system allows residents to summon help when it is needed. Such help can come from someone within the same building or from a day centre located in the neighbourhood. ▲

127 An apartment building near Stockholm that includes dwellings for persons with severe disabilities.



128
A specially designed apartment dwelling.

Fokus IV

Fokus housing, in Winnipeg, Manitoba, comprises 45 dwellings spread over four locations. It is based on Sweden's original Fokus concept, which is also the model for the current Swedish concept of "specially designed dwellings" (see preceding example). Two elements are integral to the Fokus concept: integrated housing and support services. To achieve true integration, only a small number of housing units scattered throughout a housing development are made available to people with disabilities.

130 Wheelchair-accessible balcony.

131 A resident can control and operate doors and all kinds of electrical appliances and devices by using an environmental control system.

129 Apartment building that includes 10 Fokus IV clients among its residents.

At one of the Fokus locations, Fokus IV, 10 people with severe disabilities live completely integrated in an ordinary, 112-unit apartment building. Rent supplements are available to tenants who need financial assistance. On-site support services, funded by the Manitoba Department of Health and supplied by Ten Ten Sinclair, are available to residents with disabilities on a 24-hour basis (see page 136 for information on Ten Ten Sinclair). ▲

The Shamrock Co-operative

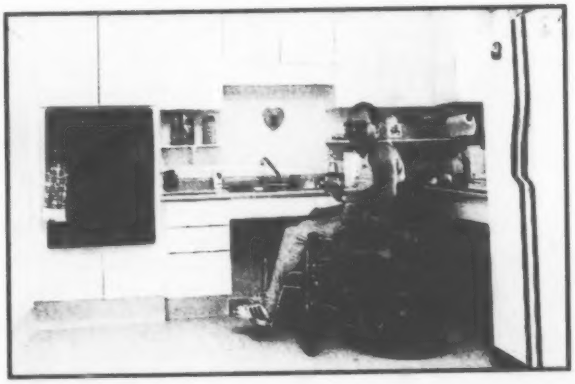
One of Canada's most innovative housing developments is the Shamrock Co-operative, in Waterloo, Ontario, which, among other things, provides opportunities for people with disabilities to integrate fully into the community.

The entire site of this 90-unit townhouse and apartment co-operative is completely wheelchair accessible. The playground surface is rubberized to cushion children's falls, a sandbox is placed at wheelchair height, and accessible picnic tables and raised vegetable and garden planters in the courtyard allow everyone to enjoy a variety of outdoor activites.

A person using a wheelchair can enter any dwelling unit in the development and use at least the living room and a bathroom within that unit. This allows for socialization and the participation in group activities of all members of the co-op. Nineteen dwelling units — 14 apartments and five single-storey townhouses — are totally barrier-free for people who have a variety of disabilities. Two elevators in the three-storey apartment building allow members of the co-op who use a wheelchair to visit any

134 Playground with rubberized surface.

132 Wheelchair users enjoy raised vegetable and garden planters.



135 Kitchen in one of the barrier-free dwellings.

133 Ground floors in the two-storey townhouses are accessible to wheelchair users.

136 A family outside their single-storey barrier-free home.

other resident. Electronic doors throughout the building also facilitate accessibility.

Many other features make this co-operative a supportive living environment for people with disabilities, including a totally accessible post office on the grounds, homemaking services and rent geared-to-income for those who require assistance. A 24-hour non-professional attendant-care support service is provided to 12 co-op members in their own dwellings. ▲

137 Accessible clothes closets.

Villa Verdi

The objective of the Ontario March of Dimes Supportive Living Centre in Hamilton, Ontario, is to enable adults with physical disabilities to live as independently as possible in the community. To do this, the Centre offers geared-to-income rental accommodation in independent living centres in two non-profit apartment buildings. It also provides a range of on-site support services on a 24-hour "as required" basis through the Hamilton-Wentworth Outreach Attendant Care Program.

139
A kitchen in a barrier-free unit.

140
Bathroom with wheel-in shower.

138 Twenty-five of the 56 dwellings are barrier-free.

Up to 25 of the Centre's clients live in Villa Verdi, a 56-unit apartment building, and up to 11 clients live in Twenty Emerald North, a 217-unit building. Accommodation is in accessible one- and two-bedroom apartments that are integrated throughout the buildings. If required, an apartment is modified to meet the barrier-free needs of an occupant.

In Villa Verdi, all units for the Centre's clients feature electronic door openers, wheel-in showers, stovetops and microwave ovens in the kitchen, and a staff call system. The front entrance to the building features curb-cuts, an accessible passenger loading zone and electronically operated doors. ▲

The Daly Co-operative

This Ottawa, Ontario, housing co-operative (which, in reality, functions like a small, highly integrated community) effectively brings together under one roof seniors, families with children (including single-parent families) and singles, including people with physical disabilities. All residents are involved in the management of their community through participation in the Board of Director's meetings and committee meetings relating to membership, communication, social affairs, recreation and finance.

The 88-unit apartment building is completely accessible to people using wheelchairs. The 14 residents who have disabilities live as independently as possible, with full, 24-hour access to on-site personal and attendant care services. These services, provided by Daly Support Services, an agency funded by the provincial government, include assistance with meal preparation, feeding, bathing and housekeeping.

An important service provided through the Daly Support Services is a "respite apartment." This unit is available on a short-term basis — from a few days to a month — to families living outside the co-operative who have members with disabilities. The objective is to provide relief to families who may be giving extensive support to relatives who are living with them. ▲

141 This 88-unit co-operative houses all age groups.

Habitations St-Joseph

From the outside, Habitations St-Joseph may look like an ordinary apartment building, but to its occupants this universally accessible building makes all the difference in the world. The design of buildings that eliminate barriers for everyone — a mother with a child in a stroller, a person carrying groceries into the building, a senior performing daily activities or a person using a wheelchair — is the guiding principle of Société Logique, a non-profit corporation responsible for the planning, construction and managing of this building in Montréal, Quebec.

At Habitations St-Joseph, the entire building, including apartments, is equally accessible and usable by families with children, seniors and persons with varying types of physical disability. With slight modifications to meet individual needs, almost everyone could live comfortably in any of the apartments. But what is most interesting is that Société Logique claims to have demonstrated that universally accessible buildings can be built with little or no increase in construction costs and no increase in building area. This claim reflects their experience not only with this particular building but also with a number of other new buildings in the Montréal area.

Design elements include the absence of steps and door thresholds throughout the building; built-in provisions that allow easy conversions to suit individual needs at any time — such as installing removable cabinets under the kitchen sink — as well as many features previously described on page 43 under Habitations Quesnel. ▲

142 Apartment building incorporating universal design concepts.

143 Reinforced walls allow for potential grab bar installation.

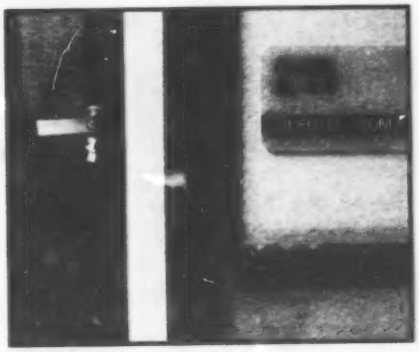
144 Universal design encourages integration.

Little Mountain Place: Home for People with Visual Disabilities

Little Mountain Place, in Vancouver, British Columbia, may be an intermediate care facility, but it has all the hallmarks of a comfortable residential environment for blind and visually impaired people. By adopting a sensitive and pleasing design approach, the architects have successfully managed to avoid the institutional flavour found in many of these facilities.

Under-rail lighting, colour-coded "neighbourhoods," corridors designed to minimize glare, notched and sculptured handrails, tactile surfaces that differentiate spaces, and heavy wood mouldings for room identification are among the custom-designed features that go a long way toward providing a supportive and comfortable environment for the residents, most of whom are older seniors and one quarter of whom are legally blind.

Access to the building from the street is via low-sloping ramps, driveways and walkways. Elevators have tactile, visual and audio aids. Twenty percent of the bedrooms are completely wheelchair-accessible and have grab bars, tilt mirrors and turning circles. ▲



147 Apartment entrance door.

145 Non-glare corridors with sculptured handrails.

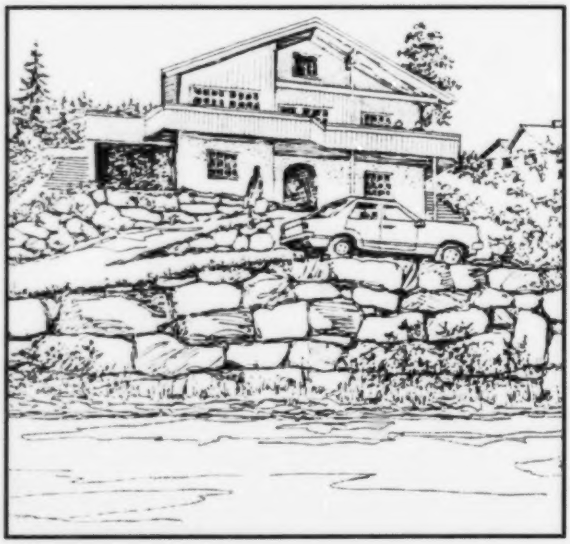
146 Different textures define circulation routes.

Barrier-Free Housing on Steep Slopes: The Norwegian Solution

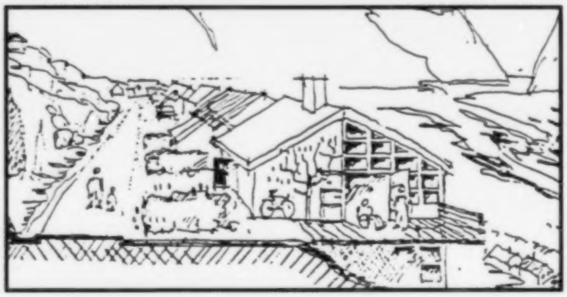
Steep slopes are a typical feature of the Norwegian topography. In planning quality single-family homes for hilly terrain, Norwegian builders and architects have been able to produce barrier-free, accessible housing under challenging conditions.

The conventional planning approach in Norway has been to locate houses on both sides of roads. Typically, this results in people only being able to access the homes on the uphill side of the road by means of steep paths leading to entrances which are often on the basement level. The main floor of this type of home is thus virtually inaccessible to people with disabilities.

As barrier-free housing is such an important policy objective in Norway, it was important to develop an approach that would make all houses built on steep slopes accessible to everyone. A solution that is proving to be cost-effective involves bringing collector roads up the slope and running a series of horizontal, single-lane access roads to groups of about 10 or 12 houses.



148 A typical hillside home.



149 Barrier-free housing on steep slopes.

In this way the homes can be entered on the main floor, from level parking areas and paths. These barrier-free homes are built on lots that are narrower and longer (20 metres by 45 metres) than conventional lots. ▲

CHAPTER 6

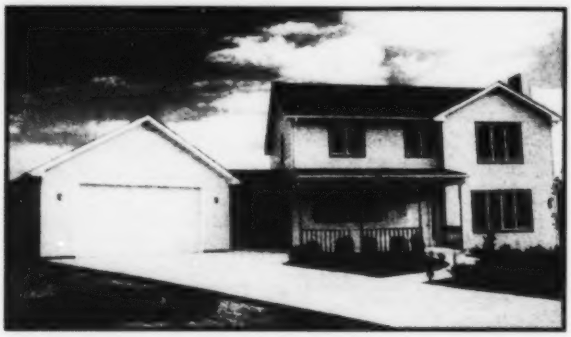
New Adaptable Housing

To build an adaptable house is to create accommodation that is not specifically intended for occupants with physical disabilities. However, the house is designed in such a way that it can be modified easily and relatively cheaply if it is later occupied by a person with disabilities.

The following examples come from the United States, the Netherlands, Japan, Canada and Switzerland. While measures to ensure that a house is truly adaptable may differ slightly from country to country, good spatial planning to provide flexibility in rearranging floor layouts is common to all well-designed adaptable housing.

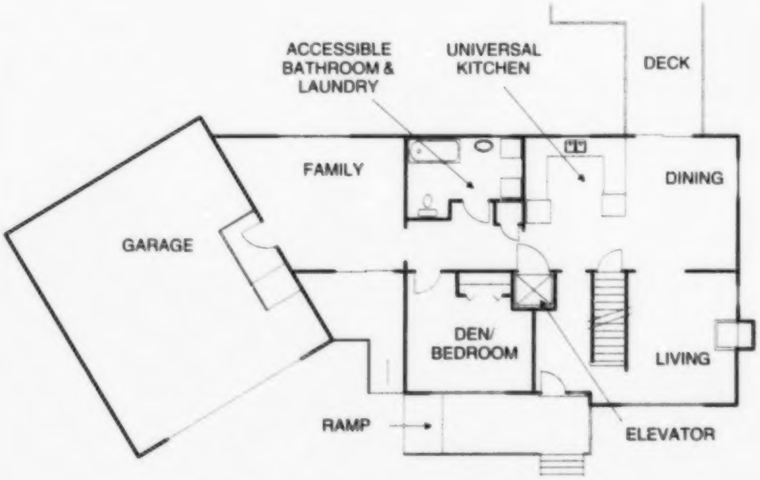
The Adaptable, Fire-Safe Demonstration House in the United States

The National Association of Home Builders' adaptable, fire-safe demonstration house in the United States is attractive yet adaptable to a wide variety of homeowner needs and preferences.

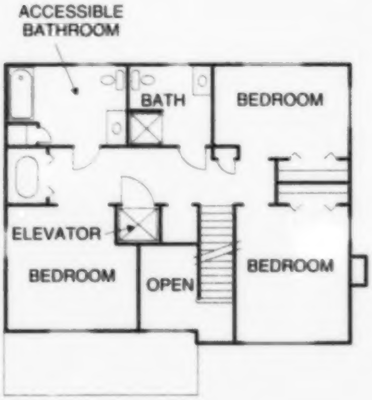


150 Demonstration house that is fire-safe, functional and adaptable.

Several features render it adaptable. The barrier-free elements include site planning that minimizes grade changes and reduces the visibility of exterior ramps; three-foot wide doorways and corridors; wheelchair-accessible living spaces; reinforced walls in bathrooms for the possible installation of grab bars; adjustable-height kitchen cabinets; and two closets, positioned one above the other on the first and second floors, that could be used to accommodate an elevator. More general treatments have also been incorporated: low-pile carpet for wheelchair movement; extra space in the kitchen and bathroom to accommodate a wheelchair or walker; casement windows with crank handles; sliding glass doors with low thresholds; an elevated fireplace opening with floor-level hearth; a bathtub with waterproof swinging doors; a large shower with a flat floor to accommodate a wheelchair; a

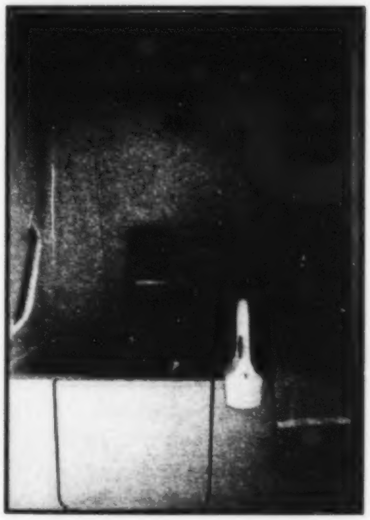

ACCESSIBLE BATHROOM & LAUNDRY
UNIVERSAL KITCHEN
DECK
FAMILY
DINING
GARAGE
DEN/ BEDROOM
LIVING
RAMP
ELEVATOR

151 First floor.


ACCESSIBLE BATHROOM
BATH
BEDROOM
ELEVATOR
BEDROOM
OPEN
BEDROOM

152 Second floor.

153 Window operation from a wheelchair.



154 Bathtub with watertight gate.

wall-hung lavatory; an 18-inch high water closet; a first-floor den that easily converts to a bedroom; and a variety of accessible products and appliances.

To make this house fire-safe, a number of innovative measures have been implemented: a flamebuster fire extinguisher and fire-resistant bed accessories; a sprinkler system activated by a central control panel, which can be connected to the local fire station; alarm sounders connected to smoke detectors, and strobe warning lights; special wall receptacles for auxiliary smoke and fire alarm devices for people who are hearing impaired; and fire-rated walls surrounding the potential elevator shaft.

The house also incorporates several automated technologies and electronic devices. At the touch of a button, the occupant can easily convert the ground-floor den to a bedroom, thanks to a mechanical wall-bed and cabinet system. An automated closet carousel provides moveable storage, while an in-wall ironing centre emerges from behind a cupboard door and pivots 180 degrees. The kitchen cabinets, mounted on flexible brackets, can be manually adjusted to three different heights.

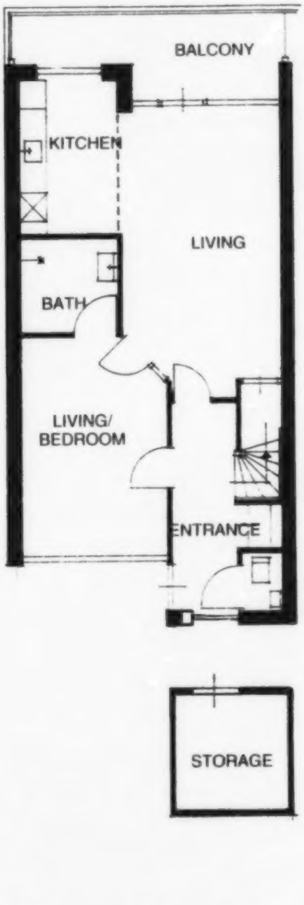
The demonstration house offers a fire-safe, functional and attractive residential environment that is very marketable to the general population, while being easily adaptable to meet the needs of persons with disabilities. ▲

Adaptable Housing in the Netherlands

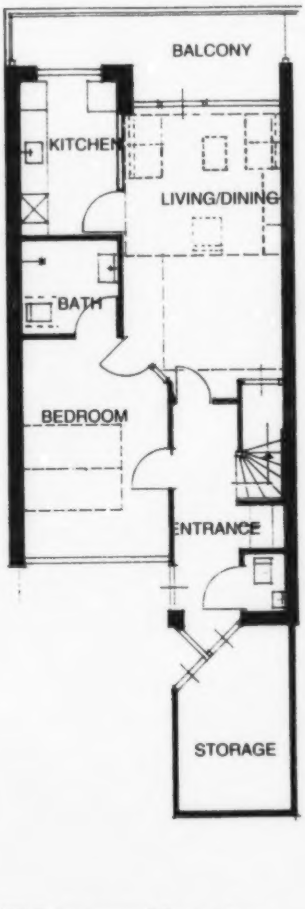
In the Netherlands, where almost 40 000 homes are adapted every year, a systematic and aggressive strategy has been implemented to ensure that an increasing number of suitable homes are made available to people with disabilities.

Since 1985, the Nationale Woningraad (the Dutch Federation of Housing Associations) has been experimenting with the concept of adaptable housing. The work, involving 40 individual projects and about 1 500 homes, has been a rewarding experience for all those involved, particularly for the 40 housing associations that have participated. Minimum guidelines for adaptable housing were developed, experimental homes were planned and built and the results of these experiments were evaluated in 1991. One interesting finding is that the building of new adaptable housing is possible at very little extra cost — estimated at no more than $220 Canadian per average dwelling. Indeed, in some cases, adaptable dwellings can prove to be less expensive than comparable ordinary dwellings and the costs of future adaptations can be reduced by 60 to 90 percent.

155 View from across the water.



156 The ground floor of an adaptable dwelling.



157 The ground floor of an adapted dwelling.

158 The entrance before adaptation.

The results also indicate that adaptable dwellings do not usually require extra floor area if the designer is creative. Ensuring adaptability may be just a matter of allocating enough space in strategic locations.

According to E.A.H. Nolte, of the Planning and Development Department of the Nationale Woningraad, an adaptable dwelling is not merely for people with disabilities, but is suitable for all people. The Nationale Woningraad's main objective is to make available as many adaptable dwellings as possible, to prevent people who become disabled from being forced to move out of their homes. At first glance, an adaptable dwelling cannot be distinguished from an ordinary dwelling; however, several features integrated into the overall design approach minimize and reduce the cost of any future adaptations that may be required.

An 11-unit project in Deventer, built by the Onze Woning Housing Association, is a good example of housing that meets the new Netherlands guidelines for adaptable housing. To begin with, it is "visitable" by a person with disabilities. Doors are wider than usual (90 centimetres, with a clear opening of 85 centimetres); door thresholds are absent except in the bathroom, where the threshold is no higher than 2 centimetres; light switches are low; and a person using a wheelchair can use a toilet on the ground floor of the two-storey dwellings.

In this project, the dwellings have one or two bedrooms on the second floor and both a bathroom and washroom on the first floor. One of the living areas on the ground floor is designed to be easily converted into a bedroom should the need arise. The stairs are also designed to facilitate the installation of a chair lift as an alternative way of providing an accessible bedroom. There is also provision for carrying out simple modifications to the kitchen, including creating knee spaces and adjusting the heights of counters and cabinets. ▲

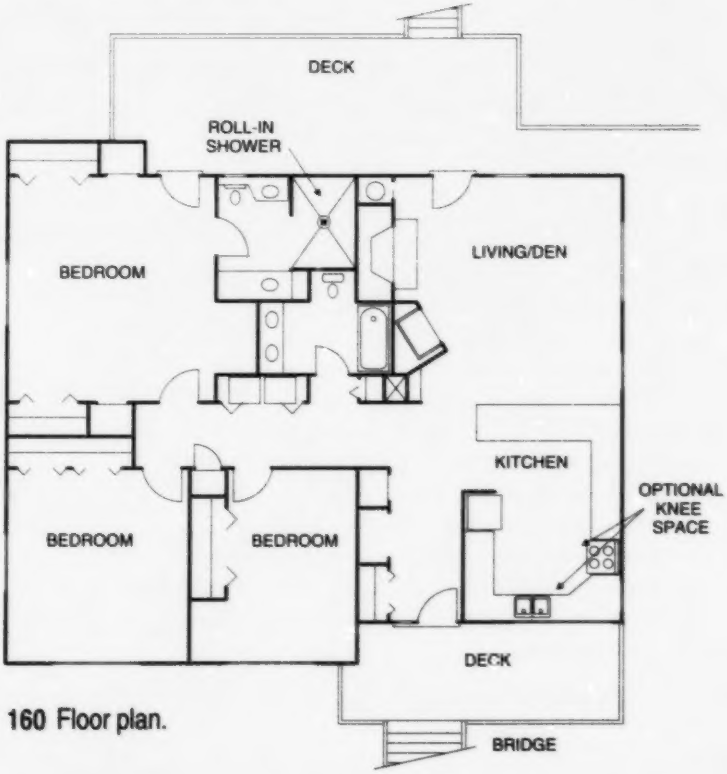
The Aldridge House: A United States Example

159 A gently sloping walkway with a bridge to the front entrance make the house wheelchair-accessible.

Barrier Free Environments Inc, in the United States, custom-designed this adaptable house for the Aldridge family. Particular attention has been paid to accommodating the current and future needs of the youngest child, who is paralyzed from the waist down as a result of an accident. In fact, the house has been designed with built-in adaptability features that will ensure complete accessibility and comfort for the youngster as he progresses to adulthood.

The house meets the current needs of the youngster's family, comprising himself, his mother and two siblings. For example, in the kitchen, the height of the counters has been set up at standard height so that his mother can prepare meals comfortably, but the counters can be adjusted at any time for the youngster. His current bedroom, which he now shares with his brother, has been designed so that it can become his "master" bedroom when he reaches adulthood: there is an ensuite bathroom to accommodate this situation. The second bathroom has two washbasins, one with a clear space underneath to accommodate his knees and protective panels to prevent scalding. Adjustable shelves in the bedroom closet will accommodate the youngster's changing requirements as he grows older.

Other adaptable design features found throughout the home include casement windows with low sills and easy-to-operate hardware; fireplace with flush-to-the floor hearth; an adjustable television shelf in the living room; a roll-in shower in the



160 Floor plan.

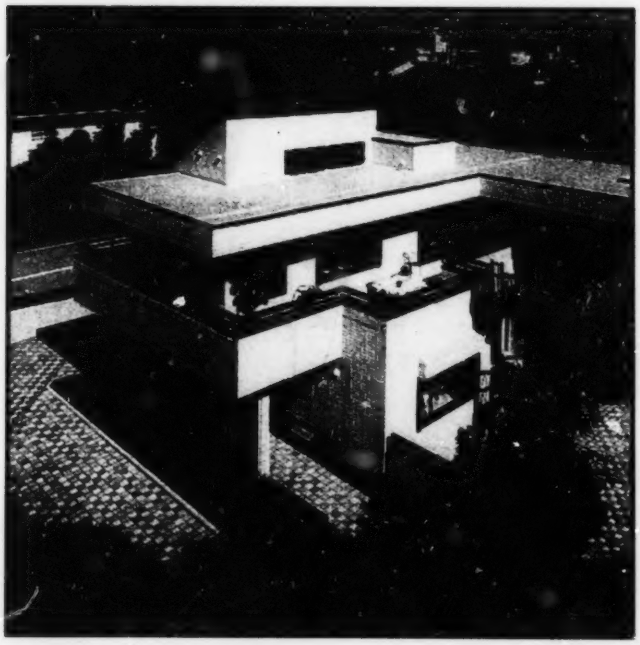
161 Adjustable section of the kitchen counter.

youngster's bathroom with a pressure-balanced anti-scald valve; and front and back decks completely accessible to a wheelchair. ▲

Life-Care Housing: A Japanese Model

Japan's population is aging, and the government recognizes a need to promote the development of housing that is designed for a variety of age groups and that will meet the changing needs of its occupants over time.

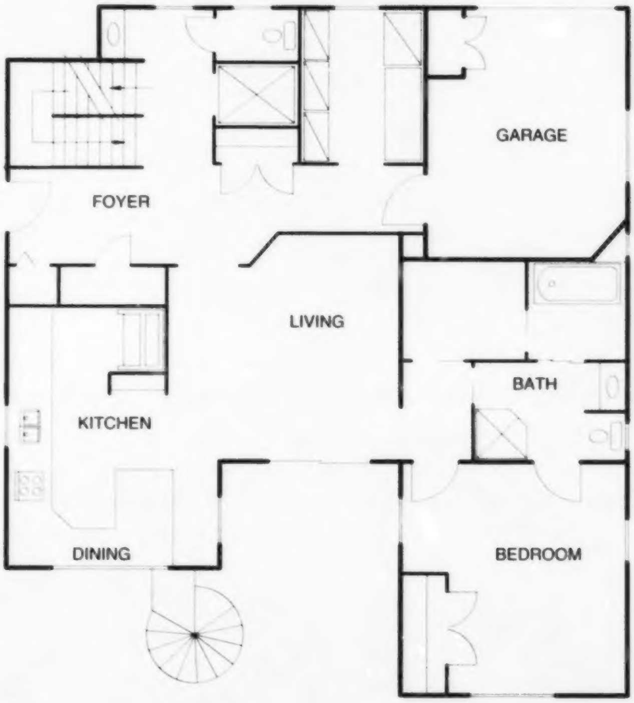
This model house in Mitaka, Japan, designed by Sekisui House Ltd, is a good example of housing design based on the life-care housing concept. A duplex, the building has been designed to house two couples. One member of an adult couple living on the ground floor has a physical disability and uses a wheelchair. An



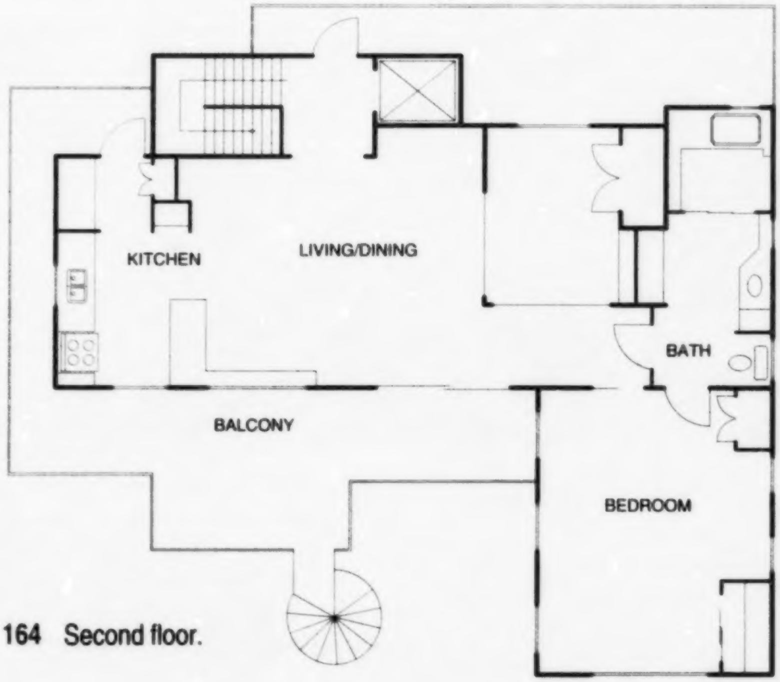
162 A duplex home in Mitaka.

elderly couple lives on the second floor, and one spouse is slightly paralyzed. Sensitivity to good interior design, colour and the spatial needs of both age groups, as well as to the physical requirements demanded by people with decreased mobility, is the hallmark of this project.

The ground-floor unit offers various aids and accessories geared to making life easier for the couple. There are automatic doors between the entrance hall and living room, and from one room to the outside; kick plates protect the automatic sliding glass doors; the kitchen has various storage trolleys on wheels and pull-out cabinets; and a hoist lifts the spouse with disabilities from the bedroom to the bathroom.

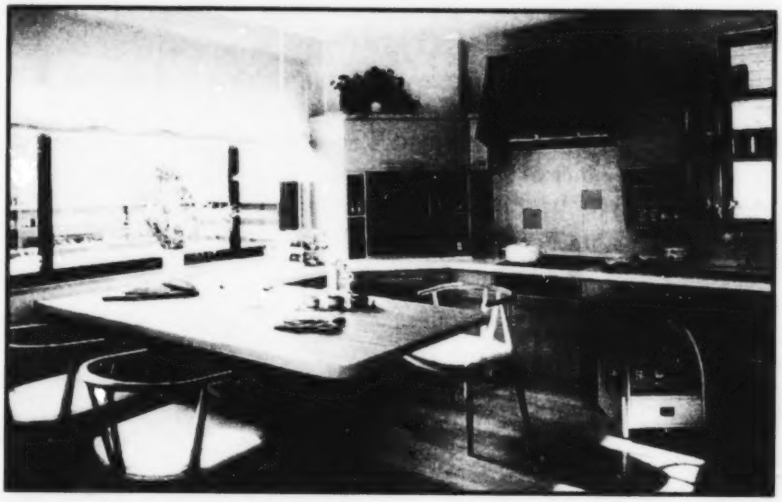

GARAGE
FOYER
LIVING
BATH
KITCHEN
DINING
BEDROOM

163 Ground floor.


KITCHEN
LIVING/DINING
BATH
BALCONY
BEDROOM

164 Second floor.

165 Accessible closets maximize use of available space.



166 Kitchen that can be enjoyed by a wheelchair user.

The second-floor unit is accessed from the ground floor by either an elevator or stairs. Among many features that accommodate the failing eyesight of the elderly couple, the architects have installed auxiliary lighting that supplements the other lights after dark, and red accent colours are used to pinpoint the handles of doors. Much attention has been paid to features that enhance the couple's safety, such as handrails in the bathroom, slip-proof flooring and minimal height thresholds. ▲

167 Hoist between the bedroom and bathroom.

Ledingham Place, Eburne Landing and The Brambles

A British Columbia architect's approach to designing adaptable housing is to facilitate room and layout conversion to accommodate the changing needs of residents. Showers can be replaced easily by bathtubs, and vice-versa. Kitchens can be readily modified to accommodate changing functional requirements, thanks to hydraulic jacks and adjustable legs used to vary counter heights.

The architect has designed three non-profit housing developments in Vancouver: Ledingham Place and Eburne Landing Housing Co-operative, both of them projects for families and singles with disabilities, and The Brambles Housing Co-operative for single mature women and couples. Through these projects, he claims to have demonstrated that adaptable housing does not have to cost more than housing in conventional non-profit developments, which only include a small percentage of dwellings designed for wheelchair users. Cost-effective adaptability is primarily a result of the efficient planning of interior space and the selective provision of economical special features or elements.

Ledingham Place

A three-storey, 33-unit building that blends successfully with the surrounding neighbourhood, Ledingham Place is home to a variety of families and singles, including persons with physical disabilities. The entire building is accessible, and each unit can be

168 Ledingham Place.

169 Adaptable kitchen with standard cabinetry in place.

170 Kitchen after adaptation.

adapted to meet individual needs. The types of adaptations available to the tenants allow older residents to age in place and permit residents with various disabilities to use the kitchens and bathrooms.

Eburne Landing Housing Co-operative

This four-level building, in which eight of the 36 units are fully adaptable, includes various features intended to aid or enhance the visual acuity of the visually-impaired and addresses the needs of persons with other disabilities. Contrasting colours and textures, warning strips at certain changes in level, raised lettering, and minimal wall projections are some of the design features used throughout the building. The adaptable units have provisions for an automatic entry door opener, if and when needed.

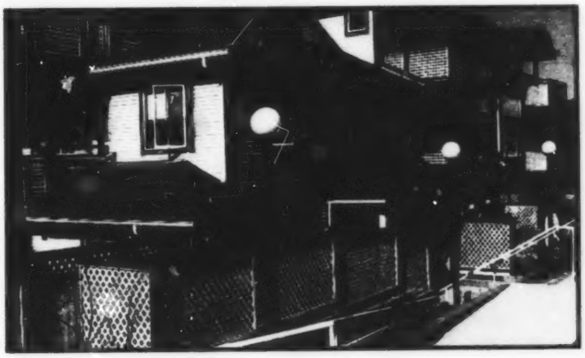
EBURNE LANDING
HOUSING COOPERATIVE
8828 HUDSON STREET
APPLICATIONS-FRONT DOOR

171 Eburne Landing.

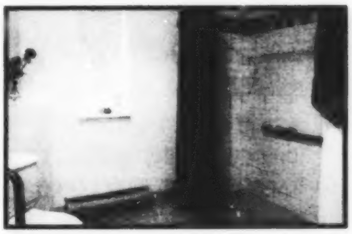
172 Ample and conveniently located parking facilitates transfers from a scooter or wheelchair to a vehicle.

The Brambles Housing Co-operative

This is the first housing co-operative in Canada to serve the particular housing needs of mature single women. In recognition of the changing needs of various residents, including persons with disabilities, the architect designed 15 of the 42 units to be readily adaptable.



173 The Brambles.



174 Wheel-in showers can be converted to accommodate a bathtub, and vice-versa.

Adaptability features include provision to simplify replacement of the bathtub with a wheel-in shower; adjustable shelves, cabinets and pantry; and removable cupboard doors and shelves under the stovetop and sink in the kitchen. ▲

Telosky Village

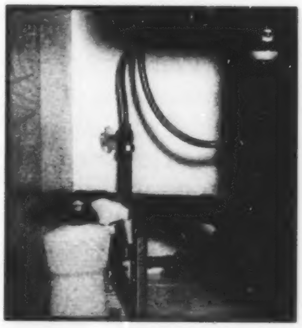
Telosky Village, a development of 43 garden townhomes in Vancouver, British Columbia, is the first private-sector initiative in Canada involving the construction of adaptable houses in an entire village complex. The homes, featuring "smart house" designs (for information on "smart house" technology, see page 161), look very much like large, ordinary, single-family homes, but inside they are equipped to go high-tech.

A fully integrated automated system (called CEBUS) can address residents' safety and security needs and manage energy consumption. All the homes in the development have been prewired, and individual homeowners can adapt and implement the system to meet their own specific needs whenever they want. For example, medical alert technology is available for seniors. The simple touch of a button on a video panel allows one to control all the various applications.

The bathrooms feature a removable threshold at the entrance to the shower stall, pressure-equalizing valves to control water temperature in the bathtub and shower, and an adjustable washbasin. Modular-designed cupboards in the kitchen can be replaced with manually or electronically activated movable

175 Traditional appearance combines with adaptability and high technology.

176 The kitchen sink can be readily adjusted to various heights.



177 Flexible piping simplifies height adjustment.

Blair Court

In designing the 39-unit Blair Court apartment building, the Vancouver Resource Society, in Vancouver, British Columbia, wanted to promote integration and independent lifestyles in the community for those with disabilities. The building, which allows individuals to live in their own apartments while still receiving the support services they require, has fulfilled its goal. It also demonstrates that private- and public-sector groups can work successfully together on special projects. In this case, the developer retains ownership of the ground-level commercial space.

Home to seniors, people with disabilities, single-parent families and lower-income groups, Blair Court provides an environment where people with disabilities can mix with those without disabilities. To accommodate such a mix, the architects introduced various adaptability features into the units, such as wall ovens and clear space under sinks and stovetops in the kitchens; wheel-in showers in 27 of the units, which can be converted to bathtubs and reconverted to showers; 90 centimetre-wide doors and 155 centimetre-wide corridors

178 Wheelchair-accessible courtyard.

cupboards. Storage closets that are located in the same position on both floors have the potential to accommodate an elevator, and walls and shower stalls are reinforced for the possible installation of grab bars. ▲

179 Wheel-in-shower.

180 Accessible stovetop and cabinets.

throughout the building; and ample space in all the units to allow a person using a wheelchair to perform daily activities as independently as possible. ▲

Adaptable Kitchens in Switzerland

In Switzerland, a popular approach to adaptability has been to institute design guidelines for homes, with a view to ensuring that they can be adapted without undue expense to meet the needs of people with disabilities.

These few basic guidelines from the Swiss Centre of Building for the Handicapped are intended to provide for a kitchen's adaptability:

- Ensure that door openings are wide enough to allow a person using a wheelchair to pass through.
- Provide for counter space between the sink and stove.
- Do not locate the sink and stove against a lateral wall;.
- To make it easier to create a clear space under the sink, do not install piping in a way that impedes extending the flooring into the potential clear space.
- To compensate for the storage space lost by creating clear space under the sinks and counters, make provision for additional accessible storage space elsewhere, for example, by installing a pantry in the kitchen.
- Provide enough clearance in front of the sink, counter and appliances to allow a person using a wheelchair to make a 180-degree turn.

Individual adaptations can be implemented once a person with disabilities has lived in a unit long enough to assess individual requirements. These might include creating recesses under kitchen counters, lowering counters and shelves, increasing clearance in front of appliances, providing supplementary table space through the installation of fold-away tables and pull-out table leaves, and lowering refrigerator compartments. ▲

CHAPTER 7

Shared Housing

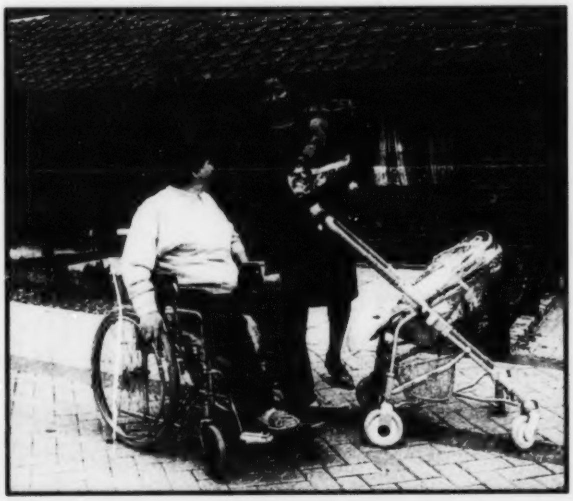
Shared housing is housing of any type and form where residents share some basic facilities, such as kitchens, bathrooms and lounge areas. Since it can provide social and economic benefits, as well as opportunities for mutual support, shared housing is often available to people with disabilities.

An increasing number of shared housing schemes are now also accommodating residents' needs for privacy and self-sufficiency. As you will notice in descriptions of the following examples, the residents of these shared housing projects have the benefit of being able to live in self-contained units or bed-sitting rooms. By virtue of their modest size, all three projects are well integrated into the surrounding community.

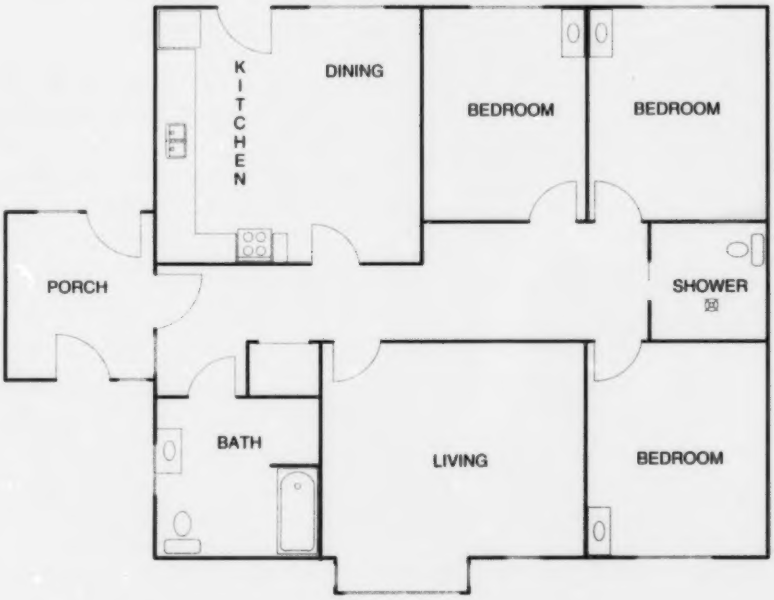
A Shared Bungalow in England

This example of a shared bungalow is located in the housing scheme built by Habinteg in Leeds, England (see page 73). The townhouses and bungalows in this scheme make up a unique community that is home to young and old, individuals and families with children, including people with disabilities. The residents have access to on-site community support services, including home help and attendant care.

Several of the housing options in this community that are available to people with disabilities involve the shared housing concept. For example, Habinteg's three-bedroom shared bungalow has separate bedrooms, each with a washbasin, for three people who use wheelchairs. Two common bathrooms with toilet and bathing facilities, a common living room, dining area/kitchen and verandah complete the layout plan. ▲



181 Three residents in the Habinteg housing scheme.



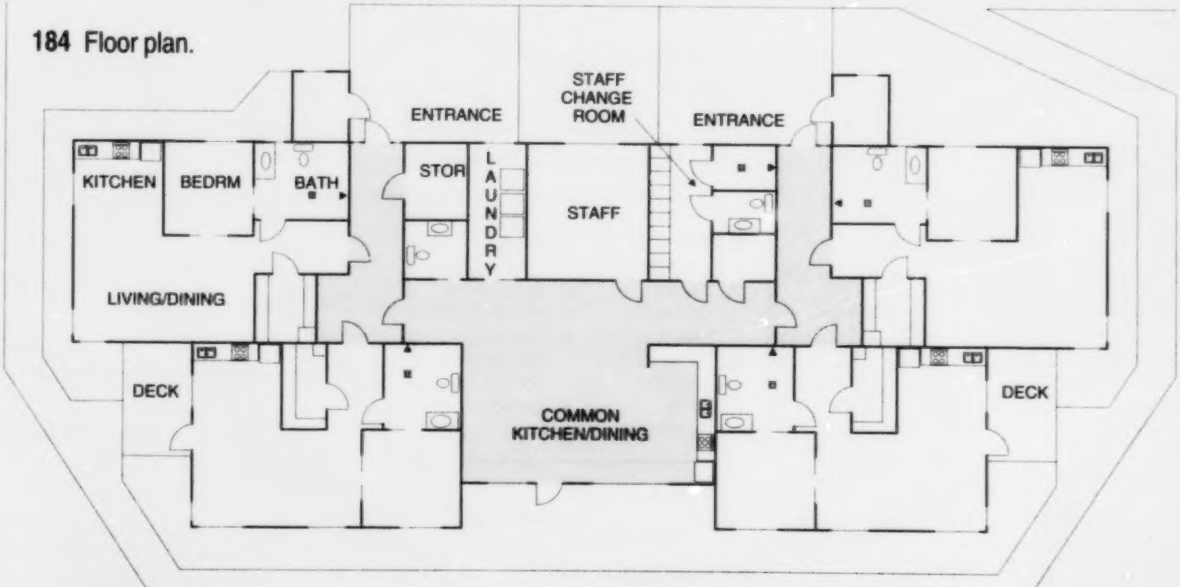
182 Wheelchair-accessible shared bungalow.

A Small Shared Housing Scheme in Sweden

One approach to shared housing adopted in the town of Skellefteå, in northern Sweden, is to house people with disabilities in small, single-storey apartment buildings that include four self-contained apartment units. These units are clustered around a common central area where meals are prepared and served. Support staff hired by the municipality help with such tasks as meal preparation, laundry and cleaning. However, each apartment unit also has its own kitchen/dining room, for times when a resident wishes to eat privately. The units contain a bedroom, sitting area and bathroom and have their own private entrance and terrace.

The mix of self-contained apartments and communal facilities affords residents the opportunity to maintain privacy or to socialize with other residents when they wish to do so. The common central area has been designed so that it can be converted into an ordinary apartment, if and when, it is not needed. ▲

183 Small apartment building in Skellefteå.



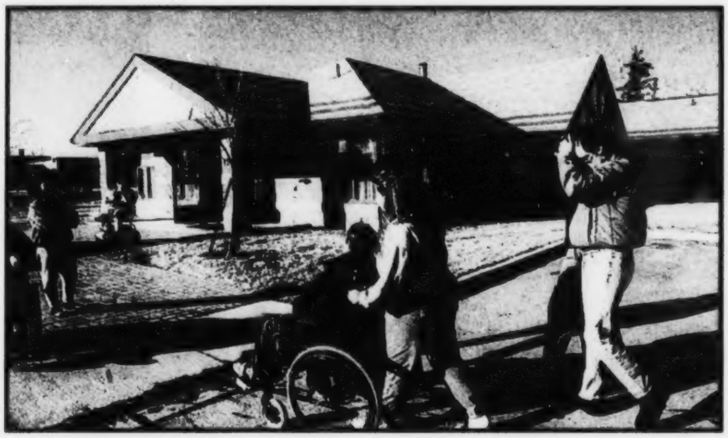
184 Floor plan.

ENTRANCE
STAFF CHANGE ROOM
ENTRANCE
KITCHEN
BEDRM
BATH
STOR
LAUNDRY
STAFF
LIVING/DINING
DECK
COMMON KITCHEN/DINING
DECK

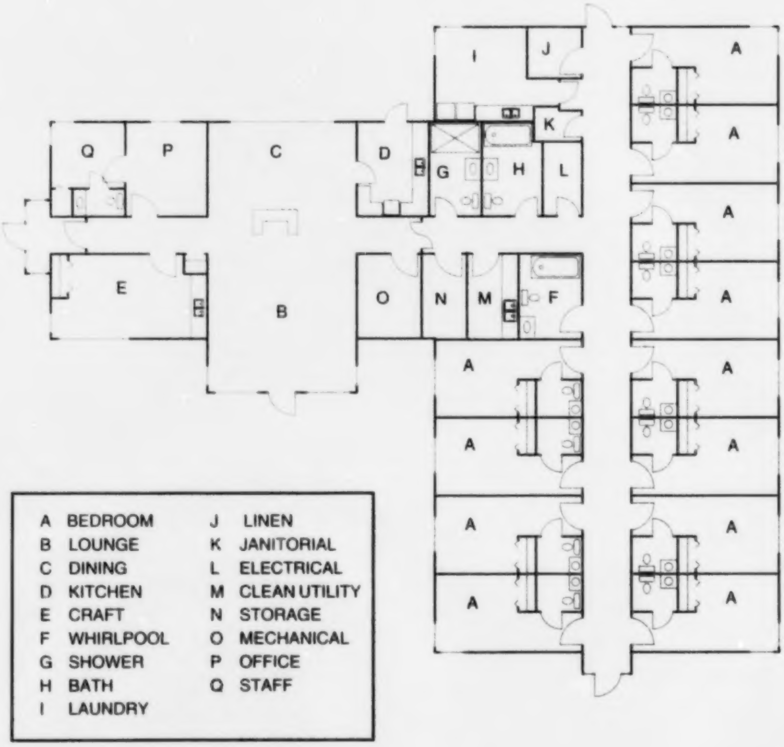
Peel Cheshire Home

As with the other 20 Cheshire Homes throughout Ontario, Peel Cheshire Home in Brampton offers independent and shared living for people who have physical disabilities.

The 12 young adults, with a range of disabilities, have their own bed-sitting rooms and two-piece bathrooms, but come together to participate in various activities and life skills programming initiatives. They help staff prepare meals, have input into the type of care and services they receive, are involved in community-run activities, work together in a "sheltered" workshop, and participate in life skills training sessions (banking, cooking, basic academic subjects). ▲



185 Peel Cheshire Home for young adults.



A	BEDROOM	J	LINEN
B	LOUNGE	K	JANITORIAL
C	DINING	L	ELECTRICAL
D	KITCHEN	M	CLEAN UTILITY
E	CRAFT	N	STORAGE
F	WHIRLPOOL	O	MECHANICAL
G	SHOWER	P	OFFICE
H	BATH	Q	STAFF
I	LAUNDRY		

186 Floor plan.

CHAPTER 8

Transitional Housing: The Road to Independence

In the past, many people with severe physical disabilities were often trapped in a homebound dependency or institutional isolation that wasted their intelligence, talent and ambition.

Recently, however, this group has become more vocal about their needs and aspirations and the provisions they require to live and compete in society. This has led to a growing social awareness of the overwhelming drive of people who are physically disabled to live normal, independent and productive lives.

Although legal and practical barriers for people with disabilities are being gradually eliminated, many obstacles remain. For some, there is the difficulty in making the transition from a protected institutional environment to independent community living. It is not a question of a simple step from one to the other as they may still depend on varying degrees of supportive care.

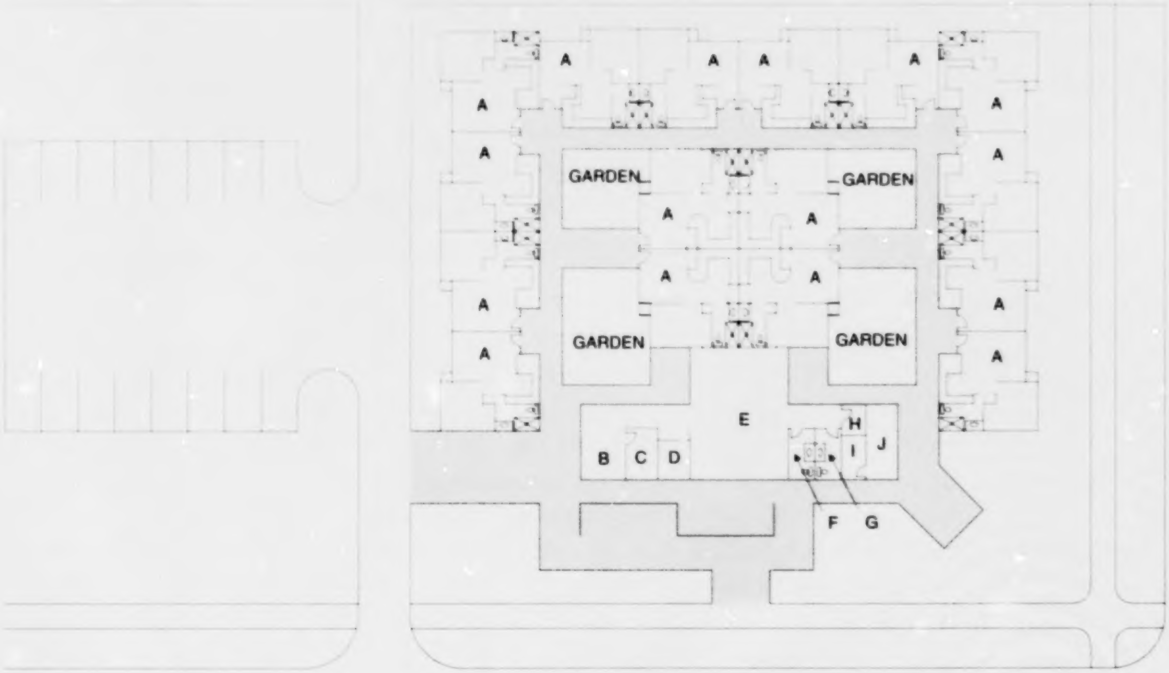
Transitional housing provides a bridge between institutional and independent community living. It is an intermediate step, providing people with an opportunity to plan and prepare for mainstream life by rebuilding their instrumental and interpersonal survival skills. With staff assistance in a supportive environment that encourages self-sufficiency, transitional living arrangements provide the vital physical, mental and social rehabilitation necessary for independent life in the community.

Creative Living II: A United States Example

187 The design of Creative Living II is in harmony with surrounding buildings.

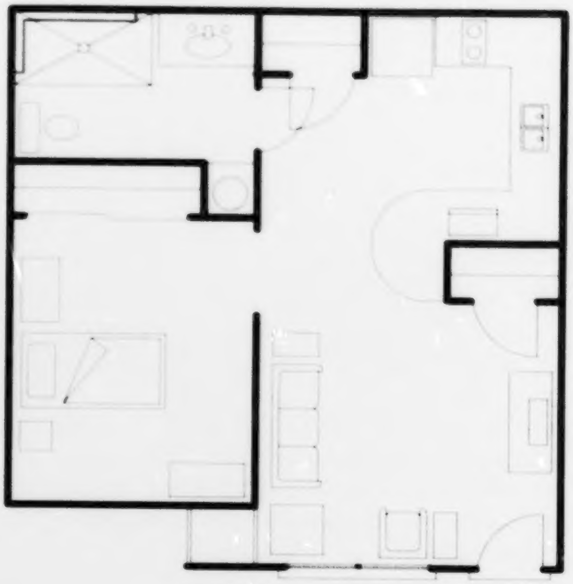
Creative Living II in Columbus, Ohio, is a transitional living development that offers young people who are quadriplegics an opportunity to develop their skills to the point where they can lead independent, fulfilling lives. The sensitive, innovative environment provided by Creative Living II encourages both independent lifestyles and a family-like dependence between residents bonded by their common disabilities and needs.

Creative Living II is an evolution of Creative Living I, the prototype of university-oriented, independent-assisted residential living for



188 The one-bedroom dwellings are clustered around a courtyard.

A	LIVING	F	MEN'S RESTROOM
B	STAFF	G	WOMEN'S RESTROOM
C	OFFICE	H	JANITOR'S CLOSET
D	ENTRY	I	MECHANICAL
E	MULTI-USE	J	LAUNDRY



189 A typical unit.

young people with severe disabilities. The Creative Living II complex clusters 16 one-bedroom dwelling units around a courtyard and covered walkways, which are linked to a multi-use lounge, a laundry and an attendant care office staffed around the clock.

This type of arrangement resembles an older family home where a number of rooms were grouped around a front core space. It works particularly well for people with severe disabilities. The self-contained bungalow units have direct access to the outside and offer the privacy of a conventional housing unit. The landscaped courtyard provides a semi-private space the residents can use for informal, family-like socializing.

Creative Living II is visually well-integrated within the existing historical, residential neighbourhood. The building is similar to neighbouring houses in colour, form, materials and scale. Its proximity to three institutions of higher learning — Ohio State University, Franklin University and Columbus State Community College — make it ideal for students with quadriplegia; the educational, medical and recreational facilities, and the transportation networks of these institutions, have contributed to the success of the project.

Employment opportunities are close by, and a ready supply of student neighbours make it easy for residents to acquire part-time personal help. This is important since tenants are responsible for making their own personal assistance arrangements.

The barrier-free design of Creative Living II is also critical to its success. The entire facility is accessible to people in motorized wheelchairs. Within the dwelling units, special features include space to park a spare wheelchair for battery recharging, oversized bathroom cabinets for medical supplies, and flexible shower heads next to sinks for attendant-aided shampoos.

By providing a supportive environment in a building that blends into the neighbourhood, Creative Living II helps residents return to the conventional activities of daily living and mainstream life. ▲

Learning Services Escondido: A Continuum of Care Model in the United States

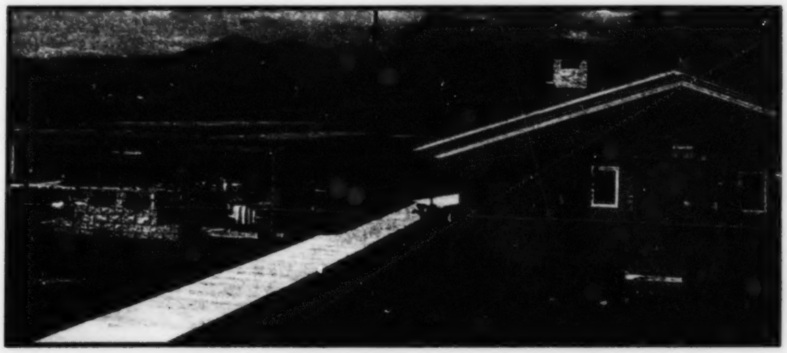
The objective of Learning Services Escondido is to help recovering victims of traumatic brain injury prepare for re-entry into the community. Situated in a downtown residential neighbourhood in Escondido, California, the facility is similar in appearance to neighbouring houses — an important consideration for therapeutic reasons. This visual integration is intended to evoke images of home and community, which are stimulating to those receiving treatment and which help to ease their passage back into mainstream life.

The Escondido re-entry program is based on a continuum of care model. Three small buildings make up the facility: the group "family" residence, the independent living house and the teaching house. These, together with a variety of housing opportunities in the community, provide clients with residential options in graduated phases. When clients first enter the Escondido facility, they are assessed by case managers in the group "family" residence over a two-week period. Then a decision is made about where they should live: in the group residence, where a high degree of training and therapy is provided; in the independent living house, which contains two-bedroom, self-contained dwellings and where training and therapy are provided to a lesser degree; or in a two-bedroom rented apartment unit off-campus, where the degree and type of training and therapy received is at the discretion of the clients.

The group "family" residence has four main areas. In the middle of the T-shaped building is a gallery/reception foyer and an adjoining recreation room. Branching off in two directions are the residents' quarters containing one- and two-person bedroom units, each with its own kitchenette and each pair of units with a shared bathroom. The independent living house consists of a pair of semi-detached, two-bedroom, self-contained dwellings. The apartments where clients who need little training or therapy live are situated off campus, but close to the centre.

All clients receive some level of social, neuropsychological and physical therapy and training from the teaching house staff. A case manager assigned to each client sets goals for the client by using the resources provided by the professional team.

All buildings in the facility provide the visual cues and technical systems necessary for orientation, safety, the establishment of living patterns and the reinforcement of daily personal routines in a therapeutic setting. The 24-hour residential setting provides continuous practice and reinforcement of functional skills.

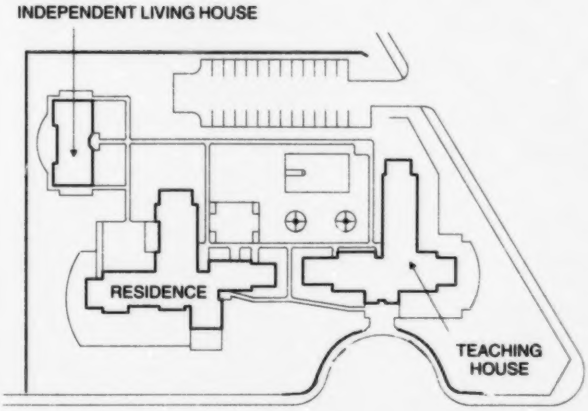


190
The group family residence and garden.

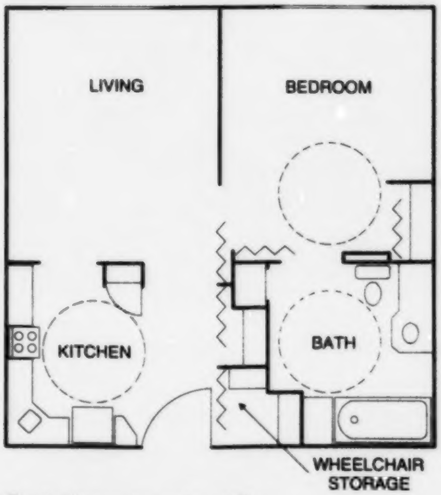
Eventually, the clients participating in the program at the Escondido Training Centre will return to a world that is not geared to making their lives easier. To make this return less traumatic, the transitional care provided at the training house must reflect this reality. Thus, while the various buildings in the facility are designed to accommodate the occupants' needs, they are also intended to challenge their abilities. ▲

Ten Ten Sinclair

Ten Ten Sinclair, a transitional housing development in suburban Winnipeg, Manitoba, gives young adults with various disabilities an opportunity to acquire the necessary skills for maintaining an independent lifestyle. The development provides a bridge between institutional environments and the community by offering a re-entry program designed to help people learn how to carry out everyday functions.



191 Site plan.



192 Typical apartments at Ten Ten Sinclair feature fold-up counters between the kitchen and dining room, lightweight folding doors at bedroom, bathroom and closet entries, corner sinks and wheelchair storage closet.

193 Low window sills enable residents to enjoy the view.

194 Accessible ovens make cooking easier.

Of the 75 self-contained apartment units in the development, 25 are allocated for people with severe disabilities (such as hemiplegia or quadriplegia), 25 for people with moderate disabilities and 25 for people without disabilities. Residents without disabilities are selected on the basis of their ability to contribute to the overall environment. Their presence and participation not only enhances the community-like atmosphere but also eases community re-entry for those residents with disabilities.

In six "assessment suites," prospective residents with disabilities are assessed for about three months to determine their potential to develop the necessary skills to live independently. The assessment includes an evaluation of the individual's need for technical devices or special home adaptations in order to maintain an independent lifestyle.

Situated on the ground floor of the three-storey building are a multi-purpose room, meeting room, lounge, library and small convenience store.

Another feature of the development is the degree of support services available to residents with disabilities. On-site staff provide residents with personal and professional assistance around the clock, seven days a week. Personal assistance is intended to help residents perform a variety of daily living activities, such as bathing, using the toilet, preparing meals and doing the laundry. Professional assistance includes occupational therapy, human ecology, social services and various business activities. Residents are responsible for their personal meals and grocery shopping, as well as making arrangements for transportation, recreation and medical appointments. They are also encouraged to participate on various boards that motivate peer-group interaction and foster experimental learning.

Ten Ten Sinclair also offers personal assistance services to people with disabilities living at Fokus IV, an apartment building in central Winnipeg (see the description of Fokus IV on page 77). The intent is to enable these people to maintain independent lifestyles. ▲

The Thunder Bay Transitional Learning Centre

The Transitional Learning Centre in Thunder Bay, Ontario, provides community-based rehabilitation services for 10 people recovering from traumatic brain injuries. Its re-entry program is designed to permit a progression in housing situations from bedsitting rooms with shared baths, to self-contained one-bedroom apartments, to independent living in the community.

The centre comprises eight bed/sitting rooms that share two common bathrooms, two self-contained one-bedroom apartments and a variety of common facilities. These facilities include a lounge, dining room, study, activity and recreation room, laundry room, and kitchen. The kitchen has a motorized adjustable unit containing a stovetop, pull-out tray and set of drawers. The two self-contained apartments or "support service living units" resemble the kind of accommodation residents can expect to find in the community and are intended for use in the final transitional stages prior to reintegration. Here, staff determine how well individuals have relearned their life skills and what types of services they will require once they re-enter the community.

The centre is completely barrier-free for people with physical challenges, as well as those with hearing and visual impairments. Personal assistance is provided by attendant staff, available on a 24-hour basis, and through a structured daily program of cognitive rehabilitation and life skills training. To serve residents best, the centre uses existing community-based support services. Once the residents "graduate" and move into the community, the centre works with local agencies to co-ordinate the range of support services they might require in their own homes. ▲

195
The small scale and pitched roofs of the building enhance its good relationship to a neighbouring residential community.

John Darling Mall: An Example from England

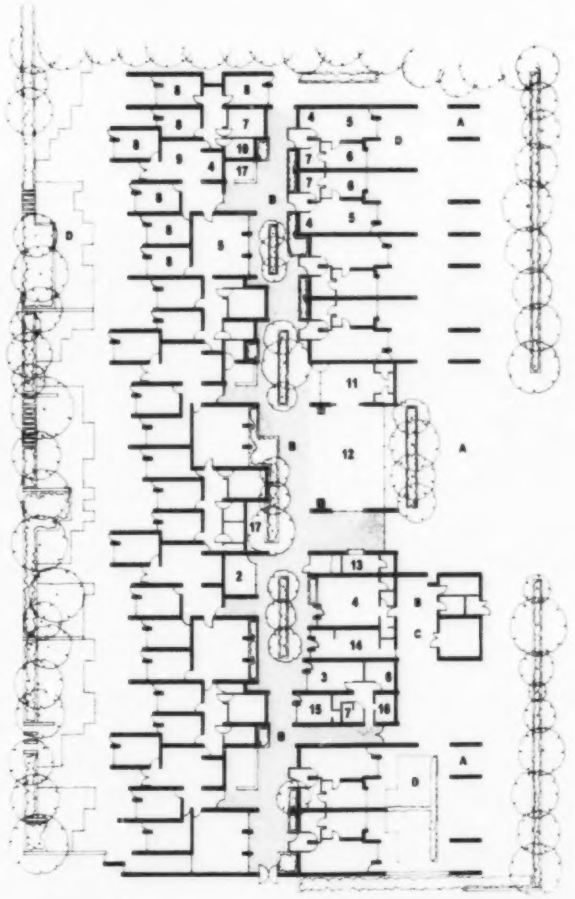
John Darling Mall, in England, is a strikingly different transitional home for younger persons with physical disabilities.

Modelled on contemporary covered public spaces, the single-storey mall contains 30 transitional living units situated on either side of a brick-paved pedestrian private street. A transparent, glazed arcade roof over the entire complex acts as a weatherproof cloak and provides protection from the elements while allowing outside light to flood the interior. Brick finishes and abundant greenery enhance the indoor mall's outdoor flavour. Its many points of interest (planters, trellises, porches), frequent changes of axis and staggered planning are far removed from traditional institutional design, while the central "street" offers a vibrant alternative to the institutional corridor.

The facility comprises 24 hostel units that accommodate residents engaged in a planned rehabilitation program geared to helping them assume a conventional role in society. In addition, six sheltered housing units are available for those who have already achieved a satisfactory level of independence but who can still benefit from the limited support provided through facility care services.

The 24 bed/sitting rooms, each with its own separate identity along the street, are clustered in irregular groups of five or six and share a kitchen, dining room, sitting rooms, baths and showers. Six of these rooms, intended for assessment, are designated for short stays of six months or less; six are for long stays of six years or more; and the rest are for stays of medium duration, between two and three years.

Common rooms include a bar, lounge, large games/concert hall, meeting room, wheelchair battery-charging room, workshop, laundry and storage. Hairdressing and shopping are available in



1	RECEPTION	9	DINING ROOM	17	BATTERY RECHARGE
2	OFFICE	10	SHOWER	18	PLANT
3	SHOP	11	BAR	A	PARKING
4	KITCHEN	12	FORUM	B	MALL
5	LOUNGE	13	STAFF	C	SERVICE YARD
6	BEDROOM	14	LAUNDRY	D	GARDEN
7	BATH	15	HAIRDRESSING		
8	BED/SITTING ROOM	16	LOCKER ROOM		

196 Site plan showing the layout of the clustered dwelling units, which are irregularly scattered about the development and are near common rooms and garden areas.

197 Two residents socializing on the internal street.

the mall. Staff accommodation, parking and a service yard are also located on site.

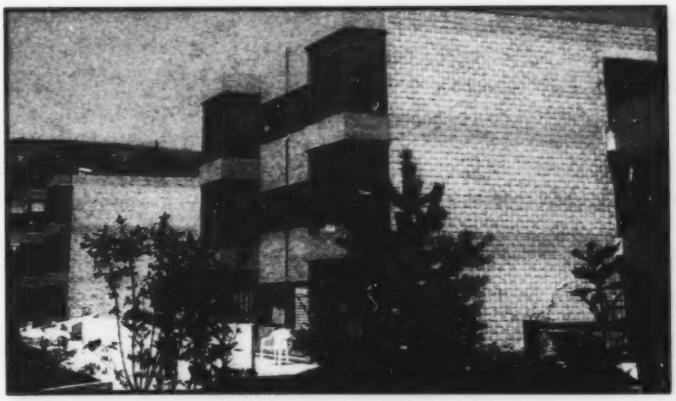
By establishing a private territory, developing a secure future and pursuing individual choices, residents of John Darling Mall learn how to lead mainstream lives. The gradient within the facility from individual bed-sitting rooms and their associated private gardens, to shared areas, to public space recognizes the importance of privacy, but at the same time provides ample opportunity for the social interaction that is necessary for the development of independence. ▲

Foyer Handicap: An Example from Switzerland

Foyer Handicap administers two homes for young people with disabilities in Switzerland: Foyer de Neuchatel and Foyer des Montagnes Neuchateloises. The basic principle behind them is to allow residents to live as others do in the community, by offering them as much independence as is physically and technically possible.

Residents must be able to carry out their daily activities and use the support services available at the Foyers. For example, they are expected to be able to make a telephone call, collect mail from the post box, and so on. As well, they have the freedoms associated with independent living; to stay out late and to come and go as they please.

An automated system allows the residents of the Foyers to perform such tasks as opening doors and windows, raising blinds, turning on lights, answering telephones, and accessing elevators. Each of the individual bachelor apartment units (30 in one home, 29 in the other) has a private bathroom and a small kitchenette. Community facilities, including a



198 Foyer Neuchatel.

lounge, a library and a dining room, facilitate social and group interaction.

Each Foyer also incorporates an "occupational" sector. At Neuchatel, workrooms provide an opportunity for residents and people with disabilities living outside the Foyer to obtain training in the use of computers and other automated office equipment. At Montagnes Neuchateloises, a large kitchen allows residents to provide a hot catering and confection service to clients outside the Foyer.

Both Foyers provide opportunities for contact between residents and those living in the community. A physiotherapy room and swimming pool at Neuchatel serve the therapeutic needs of the residents of both Foyers, as well as of others living in the community. A privately owned and operated restaurant offers meals to residents and the community at large.

The Café Bistro de Quarter at Montagnes Neuchateloises provides a similar opportunity for greater socialization. Here, an extension of the Foyer's cafeteria offers refreshments to people living in the community. And Foyer de Jour, an innovative outreach day care service component, helps people with disabilities living outside the community to remain in their own homes. This innovative outreach day care service teaches people that they can live independently and offers some tangible hope to those who eventually want to move out into the community from a Foyer residence.

Foyer Handicap does not feel that it is sufficient to simply create modern and appealing homes for people with disabilities. Quality of life must incorporate the total living environment. ▲

199 The dining room at Foyer Neuchatel.

200 Workrooms provide opportunities for training.

CHAPTER 9

Housing Options for Environmentally Hypersensitive People

• •

Environmental hypersensitivity differs from most other disabilities since sufferers may show no signs of their disability. Furthermore, the condition has many manifestations and degrees of severity, and because pyschosomatic factors are involved in some cases, the medical community is faced with the challenge of defining and knowing how best to treat people with such disabilities. The following description (from the published proceedings of a Health & Welfare Canada workshop on environmental hypersensitivity, held in Ottawa in May 1990) helps to sum up the opinion of the medical community:

> ***“ The medical label given to a patient may lead to problems qualifying for various disability benefits. Given its clinical prominence and the attendant socioeconomic costs, multiple chemical sensitivities [another term for environmental hypersensitivity] is worthy of serious scientific study. In the meantime, however, the patient should not be caught in the medical debate — and denied social benefits. Benefits should be based on defined functional disabilities, not on the medical label. Ministries of Health should be responsible for ensuring that there is no discrimination against patients by insurance companies in regard to coverage for medical-related expenses. ”***

Notwithstanding the difficulties of diagnosis, Canada Mortgage and Housing Corporation (CMHC) has supported research on this subject as it relates to housing since 1984. Over the past few years, the Corporation has made provisions

through the Residential Rehabilitation Assistance Program to financially assist people to modify their homes if the home environment has exacerbated their disability.

A large proportion of environmentally hypersensitive cases stem from chemical hypersensitivity: the people affected have become extremely sensitive to a wide range of chemical air pollutants that can come from synthetic as well as unprocessed natural materials. In less typical situations other elements of the environment can severely reduce a person's ability to function. One unusual case involving hypersensitivity to light serves to illustrate that physical improvements to the home environment can, and often do, substantially improve the health of the occupant — a fact borne out by a 1990 CMHC study that tracked the medical histories of 29 environmentally hypersensitive persons. Although the study makes no pretence of scientific rigour, it found that more than 80 percent of the people who participated noted a striking improvement in their health when a clean living environment was achieved.

The Salares Home

Many people react adversely to such common airborne contaminants as moulds and pollens. But for the environmentally hypersensitive, the typical manifestations — asthma and other breathing difficulties, eczema, general fatigue and lack of vitality — are triggered at much lower concentrations than usual. Reactions are extreme, even debilitating to some. For these individuals, even the chemical contaminants found in building materials and home furnishings are intolerable, and homes built to regular standards are not adequate.

201 Kitchen cupboards and shelves built from solid birch.

202
Home free of building materials and home furnishings that contain chemical contaminants.

In the case of an Ottawa, Ontario, couple with two environmentally hypersensitive children, the building solution that ultimately resulted in a decreased dependency on medication and a marked improvement in physical health and general well-being lay in the establishment of an indoor environment free of all known biological and chemical pollutants.

The creation of such an environment required thoughtful planning. Building materials were chosen to be free of chemical contaminants and tolerable to the children. Because they contain formaldehyde and other volatile organic compounds, plywood and particleboard were not used. Even such natural woods as cedar and pine, which contain resins that trigger asthmatic attacks, could not be included. In the end, cabinets and trimwork were built in solid birch; windows were custom-made in redwood to avoid wood preservatives.

Because carpets are a source of numerous chemical emissions when new and a harbinger of mould growth as they age, they were avoided altogether. Instead, all floors throughout the home are in ceramic tile on concrete. The unpainted interior walls are plaster on gypsum lath, while the exterior is an attractive, low-maintenance stucco with cedar trim.

An electric forced-air system combined with passive solar heat obtained through an appropriate building orientation is used to heat the house. The house is well insulated and built on a concrete slab, with a continuous vapour barrier beneath the slab, above the ceiling and within the walls. This minimizes infiltration of airborne contaminants into the house.

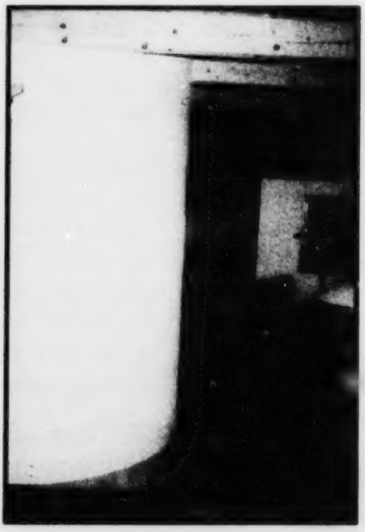
The ventilation system in the Salares house is critical to the achievement of a highly controlled, pollution-free indoor environment.

The stainless steel air-to-air heat exchanger provides fresh air to living spaces and exhausts stale air from moisture-generating areas (laundry, kitchen and bathrooms), furnishing comfort while preventing mould growth. A filtration system removes airborne particles. ▲

The Non-Allergenic House: A Danish Example

203 The Danish "clay-and-wood" house.

When he developed the "non-allergenic house" — or clay-and-wood house, as it is called in Denmark — Danish architect Poul Stokkebo created a new architectural and design concept. Armed with his own modern, yet timeless, design and construction philosophy, Stokkebo based his design on optimal inner-climatic considerations. This typical Stokkebo house is constructed with natural materials, exhibits flexible and dynamic spatial



204
This view of the living room shows the plastered staircase, wood floors and wood ceiling beams — features typical of the Stokkebo approach to house design.

functions, and features new colours and perspectives. The ceiling is arched on bare beams, and its "climate" floor is sealed to stop radon penetration.

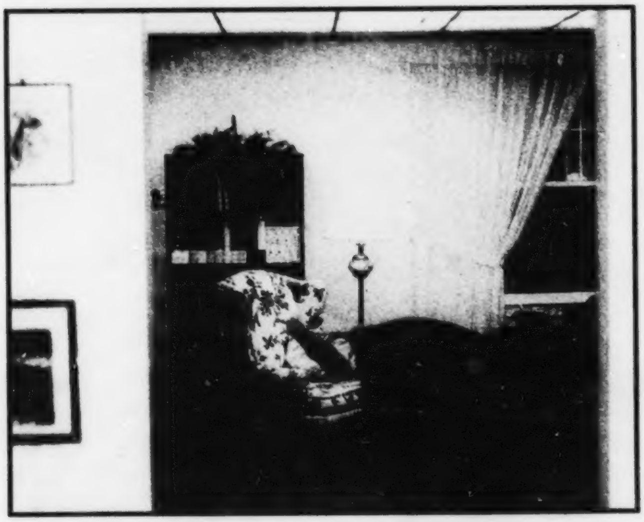
The use of channelled "clay brick" is one of the most innovative and hypo-allergenic aspects of the Stokkebo house. His newly patented channel brick is a practical solution to the unhealthy aspects of today's sealed houses. Made with horizontal and vertical channels, this type of brick simplifies construction and permits easy installation and maintenance of the electrical and telephone cables and water pipes. The brick also accommodates heating pipes to heat the walls, which in turn radiate heat to warm the house.

When a house is very airtight, there is no free exchange of air from the inside to the outside. This leads to pollution of the inside air and an unhealthy living environment. In the Stokkebo house, ventilation is achieved in a controlled manner through the walls, where the air is able to circulate through the cavities in the brick. ▲

A House with Special Lighting

Where traditional anti-depressant therapy failed to work for a Halifax, Nova Scotia, woman with Seasonal Affective Disorder, the innovative alteration of her physical environment succeeded. For this woman, her quality of life was enhanced by having the lighting system in her home completely redesigned.

The woman used to be confined to bed on dull days. However, the brightness of a sunlit room has been approximated with the permanent installation of special fluorescent tubes in the kitchen, living room, dining room and bedroom. She can now function in her home regardless of the external environment. ▲



205 Special fluorescent tubes in the living room ceiling.

A Multiple-Unit Building: A Danish Example

To keep down the costs of its 42-dwelling housing scheme, Denmark's Dalum Housing Association used a newly introduced sheet steel structural system. Every member of the two-storey structure is built with sheet steel, even those that have traditionally been built with wood. The exterior walls were insulated with mineral wool, cladded on the outside with plastic-coated steel siding and on the inside with plaster boards.

206
Dalum Housing Association's multiple housing scheme.

To make the housing suitable for people who are environmentally hypersensitive, all the floors were finished with linoleum and other natural products, and the kitchen and bathroom cabinetry was built in natural pine. A mechanical system that promotes healthy indoor air quality by maintaining proper air exchange rates and filtering conditions was also provided. ▲

CHAPTER 10

Housing for People Who Have Experienced Mental Health Problems

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For many people who have experienced mental health problems, the road to independence can be very difficult. Regular employment is often out of reach, and bill payments can be impossible without social subsidies. In addition, mental health problems are not generally well understood in our society, and gaining community acceptance can be difficult, particularly when it comes to finding a place to live.

The pressure on people recovering from mental health problems is to find community-based solutions that meet their unique needs. Fortunately, a number of non-profit organizations are now offering supportive services: education and training, pre-vocational day programs, and assistance in acquiring housing.

People recovering from mental health problems can only be assured of quality of life if they are housed in a supportive environment that is geared to their particular needs and preferences. In some cases, this might mean sharing a home with a small group of people; in other cases, an independent lifestyle in self-contained dwellings might be more appropriate. What is most important is that they have access to the types of support services that they need and want, regardless of the type of accommodation in which they have chosen to live. The objective of this section is to describe some of these options.

Hammond Road House

The most remarkable thing about Hammond Road House, in southern Ontario, is that this modern, single-family dwelling is not a single-family dwelling at all, but a home for people who have experienced mental health problems. Well integrated in an established neighbourhood close to services and public transportation, the large home is an adaptation of the typical suburban dwelling currently being built in the area. The conventional exterior of the home belies a unique interior, which has been significantly modified to accommodate eight residents in a "family" atmosphere with 24-hour support on site.

Through its Supportive Housing Program, a local branch of the Canadian Mental Health Association provides the residents with a range of support services designed to encourage responsibility and decision-making. Residents are expected to plan their own activities and do their own household chores, including housekeeping. The staff's role is to help them establish daily routines, to provide support, education and self-awareness, and to advocate on the residents' behalf.

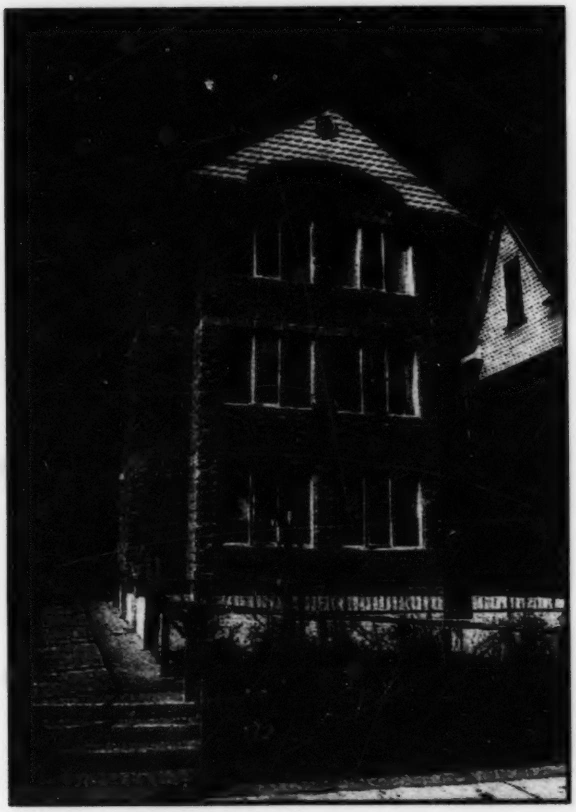
The ground floor contains a large kitchen, dining area, living room, family room, study and staff office. To facilitate interaction and socializing, the living and dining rooms are large enough to be enjoyed by all the residents at one time. On the second floor, clustered around a central staircase, are eight bedrooms and two shared bathrooms. A laundry room, multi-purpose room, furnace, storage and workroom are located in the basement. There is also a garage and a large backyard, which is ideal for individual and group outdoor recreation. ▲

207 A single-family house that isn't.

A Self-Contained Apartment Building

Centrally located in Toronto, Ontario, and situated opposite a large urban park, this integrated, 25-unit, four-storey apartment building is for people who have experienced mental health problems. Sponsored by the Supportive Housing Coalition, the building itself is small enough to enable residents to form supportive associations and friendships, while the self-contained apartments provide privacy not afforded in shared apartments or group home settings.

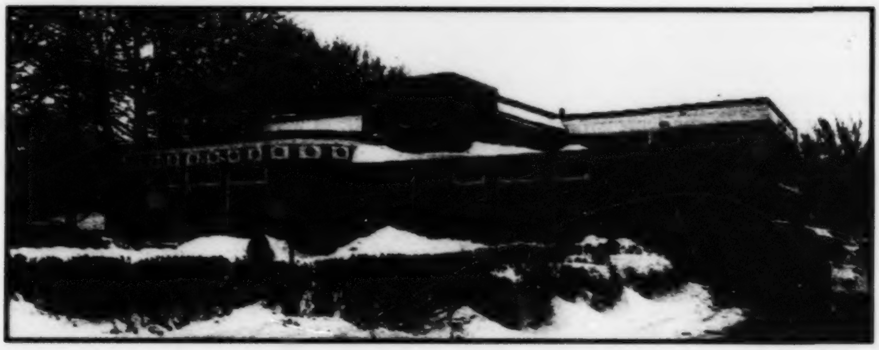
A common lounge is located on the lowest level, and machines in the adjacent laundry room are free to residents. An intercom system provides a measure of security to the building. To use it, residents are assigned a security code for which they have to sign off. The building is maintained by a superintendent and cleaning staff. Because the residents require little or no support services, on-site support staff are not available. However, residents are linked to community-based support service agencies, which provide services on an as-needed basis. ▲



208 Apartment building sponsored by the Supportive Housing Coalition.

Fitzroy Centre

An innovative housing scheme in Prince Edward Island for people who have experienced mental health problems, Fitzroy Centre's supportive housing environment, based on the clubhouse model, enables individuals to achieve the necessary skills and level of confidence necessary to lead productive, independent lives.



209
The Fitzroy Centre apartment complex.

The Centre's 24-hour integrated services program is a way of ensuring that individuals have access to the required support services. This component, combined with the rent supplement assistance available for eligible residents, has given individuals the means to move gradually from supportive living arrangements to more independent living opportunities in the community.

In addition to the 17 fully serviced, self-contained apartments at the Fitzroy Centre apartment complex, accommodation options include Longworth House, a home shared by 13 people who need minimal support; and a number of self-contained apartment units scattered throughout the community, leased from private landlords. Eligible individuals receive financial assistance under CMHC's Rent Supplement Program.

The Fitzroy Centre also contains a multi-purpose room and the offices of the local branch of the Canadian Mental Health Association. ▲

CHAPTER 11

Options for People with Dementia

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Dementia is defined as the loss of the ability to satisfy one's own needs and take care of oneself. It is the joint name for the symptoms of different diseases, including Alzheimer's, that impair the brain and nervous system. The early stages of dementia include memory loss, problems in motor ability and orientation, and problems in recognizing objects and language. Later stages include incontinence and loss of the ability to walk, and nearly complete loss of language, cognitive skills and competency in activities of daily life.

The result of such behavioural, physical and cognitive ailments is that life in a regular dwelling is extremely difficult for people with dementia. Subject to accidents and falls as a result of their decreased cognitive and motor capabilities and increasingly in need of supervision and personal assistance, people with severe dementia are generally removed from their homes and placed in institutions that are often not equipped to meet their needs.

The impact of institutionalization and the disruption of routine and familiarity can be traumatic for a person with dementia, aggravating disorientation, provoking confusion and accelerating the progress of the disability. Even if institutionalization is considered to be an acceptable option, the projected growth in the elderly population *could result in a shortfall in institutional places. Housing solutions that help to meet the needs of people with dementia and their families could prove to be preferable and less expensive than additional institutional care.*

Because safety and security are of great concern for people with dementia, new design approaches and technologies must be developed and applied. Ideally, these should reflect a deep understanding of the relationship between the built environment and human capabilities, but this is hard to achieve since people with dementia have difficulty expressing their point of view and making their individual requirements known. However, as is shown by the following examples from France and Sweden (where close to 20 percent of the population aged 85 and over suffer from some form of dementia), it is possible to develop creative housing options that help people with dementia to remain in the community.

The Therapeutic Apartment in France

In France, in the heart of one of the oldest neighbourhoods in Toulouse, there is a "therapeutic apartment" that has been modified for an elderly couple of modest income. This one-bedroom apartment has helped to make it possible for two people, one with Alzheimer's, to remain together in their own home and community.

The modifications were carried out on a pilot basis to meet a number of precise therapeutic objectives. Nevertheless, the apartment's special features are integrated into a "normal" living environment, making the interior and exterior of the dwelling appear the same as any other.

Safety was of great concern. Each window has a special safety-glass shield that protects the occupant from falling when the window is open for ventilation. The door to the unit has a code combination lock to prevent wandering. Fixtures considered to be hazardous were eliminated, replaced or protected. A thermostatic faucet was installed to prevent scalding. Furniture is stable, without angles or sharp edges. To prevent falls, thresholds were removed, carpets were nailed to the floor, and slippery surfaces were replaced with non-slip surfaces.

To compensate for cognitive defects, a number of temporal and spatial benchmarks were installed. Conspicuous clocks and calendars help the resident keep track of time, while signs on doors, the use of bright colours behind grab bars and handles, thoughtful and consistent furniture arrangements, night lights and other illuminated benchmarks help her to find her bearings.

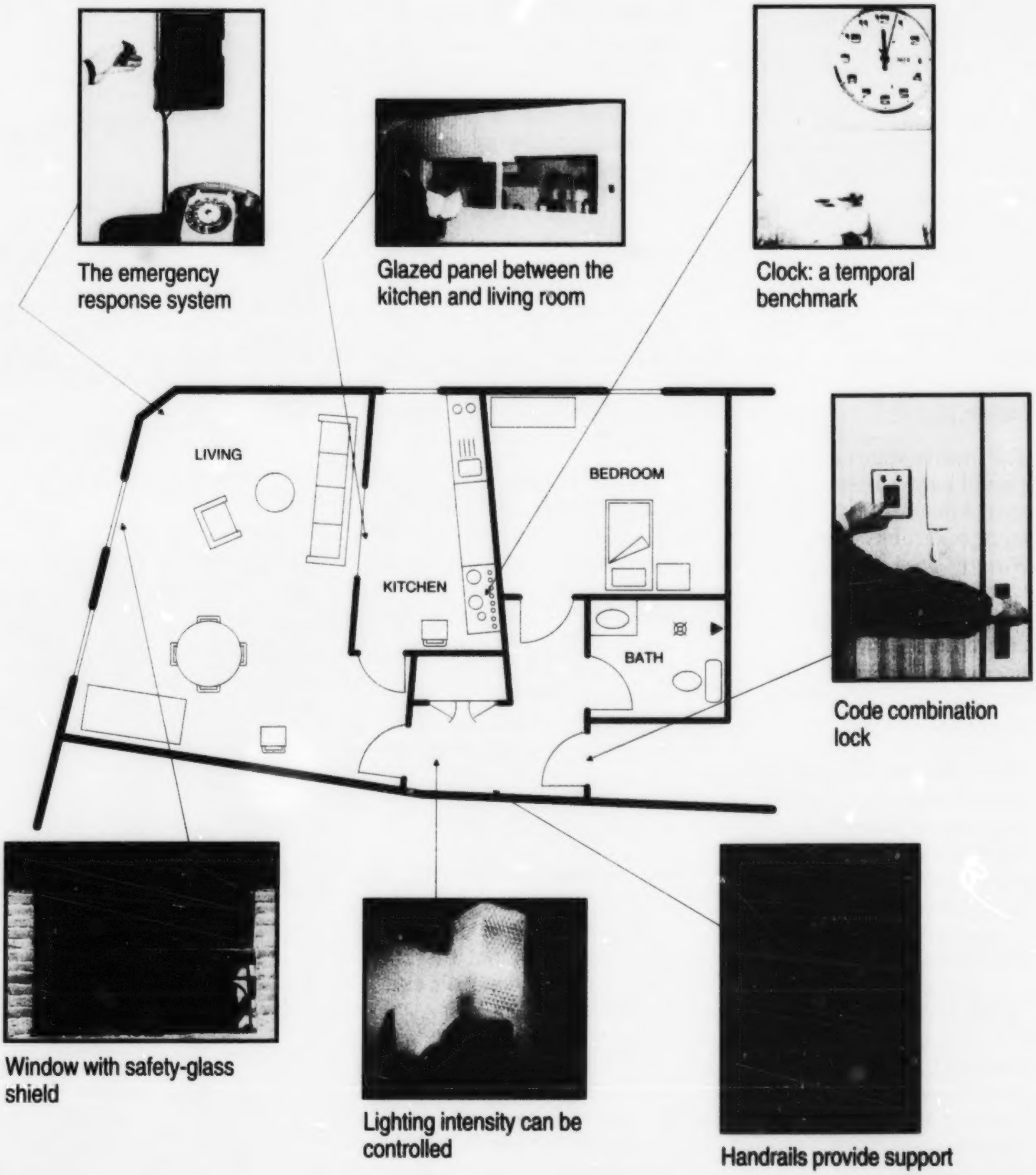
Chiming clocks and pre-programmed musical interludes on the audi-system provide auditory stimulation, while familiar objects and photographs displayed around the apartment are emotionally stimulating. Illuminated murals of different colours help establish routines, such as rest periods, bedtime and mealtimes.

The design of the apartment also helps to eliminate physical barriers. The toilet is near both the bedroom and living room in consideration of incontinence, and a bathroom cupboard conceals various aids and a hermetically sealed garbage can. To encourage healthy and safe eating, the kitchen is attractively arranged with highly visible and easy-to-reach elements. A glazed panel between the kitchen and living room allows for supervision from other reference points. To compensate for failing vision, light intensities can be adjusted throughout the apartment.

A sofa-bed for the spouse allows for privacy during periods of temporal disorientation, while sound-proofed walls and floors prevent disturbance to neighbours. A telephone alarm system provides security. ▲

LA BARCAROLL

210 The therapeutic apartment is situated on the top floor of this building.



The emergency response system

Glazed panel between the kitchen and living room

Clock: a temporal benchmark

Code combination lock

Window with safety-glass shield

Lighting intensity can be controlled

Handrails provide support

211 Floor plan and innovative features

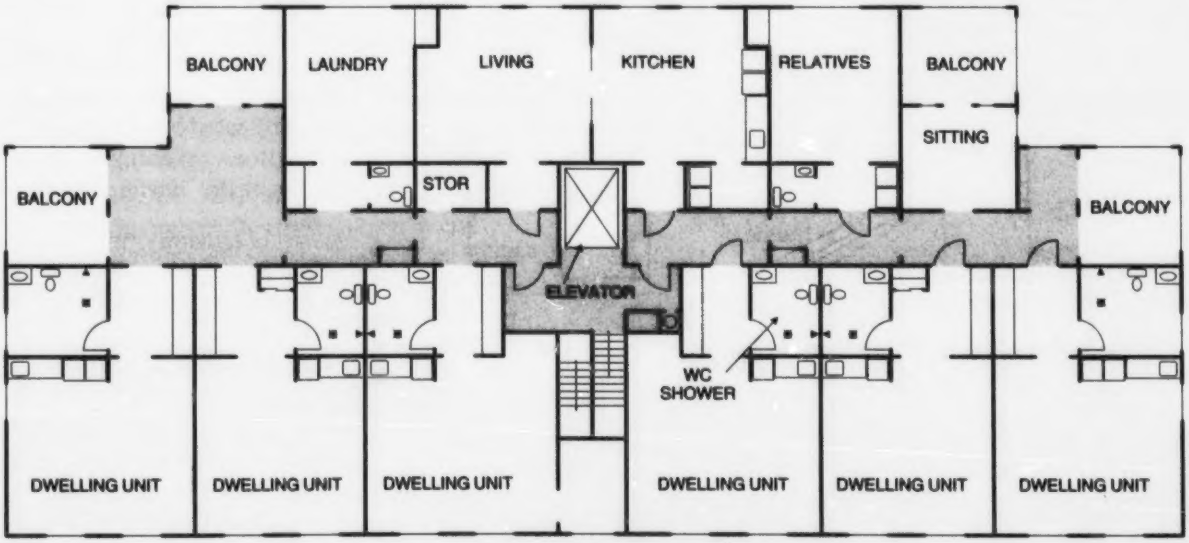
Clustered Homes and Clusters of Homes: Two Swedish Examples

The critical concerns for people with physical disabilities are their need for accessible and adaptable homes, and for appropriate support services. For people with cognitive impairments, Swedish researchers consider social organization and social space to be at least as important. With this in mind, they have proposed two main approaches to housing for people with dementia: "clustered homes," usually six to eight dwelling units sharing common facilities; and "clusters of homes," clusters of ordinary dwellings complemented by community-based support service centres.

With a cluster of homes, residents live alone or with their families in their own homes, and walk or travel to community facilities or to day-care centres. However, when dementia becomes severe, a move to a clustered home may be necessary.

212 This high-rise apartment complex, in Sanna, includes a clustered home.

Because activity and interaction between residents and staff is psychotherapeutically beneficial, the clustered home is considered the best option for people with severe dementia. The individual dwellings in a clustered home may be bachelor units (each with its own kitchenette, bathroom and bed/sitting room) or


BALCONY
LAUNDRY
LIVING
KITCHEN
RELATIVES
BALCONY
SITTING
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STOR
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ELEVATOR
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SHOWER
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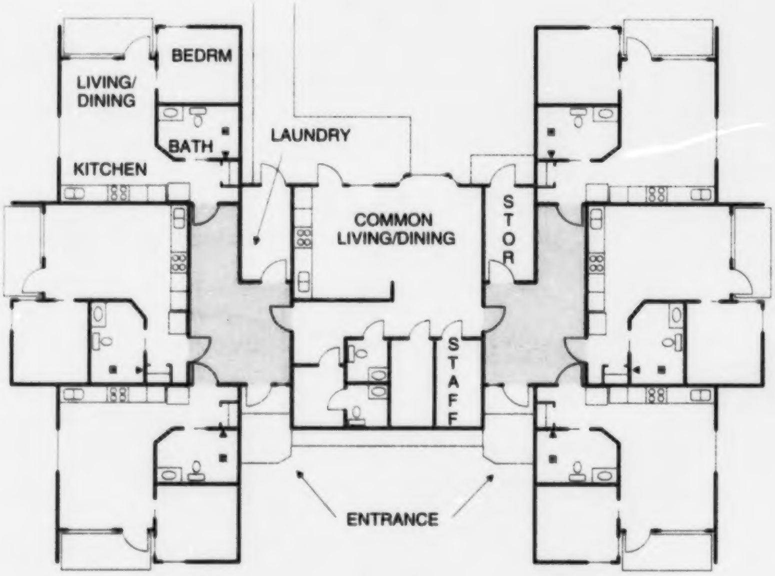
213 The clustered home on the top floor of the high-rise building in Sanna.

214 A clustered home in Tanum.



215 Floor plan of the clustered home in Tanum.

one-bedroom units (each with its own kitchenette, bathroom, living room and bedroom). The most important feature of the clustered home is its common areas — a kitchen, a dining room and TV/music/hobby/work and living areas. A clustered home can be located in a multi-storey apartment building (see the example in the Sanna building), or it can be in a small, self-contained, single-storey building (see the example in Tanum).

Orientation becomes increasingly difficult as dementia progresses. This leads to increased inactivity, apathy, loneliness, restlessness and confusion. The more severe the dementia, the harder it becomes to find and recognize other people in the community. The establishment of close personal interaction in a small community and in a calm and uncomplicated environment is, therefore, essential to the success of the clustered home.

Design is critically important. People with dementia may not be able to remember where they are going or where they are coming from, and an inappropriate layout may add to their confusion or prevent them from taking part in activities. The layout of both the individual dwellings and common areas should be simple and easy to follow, with direct and close connections between the two. Corridors with many doors should be avoided.

Because people with dementia have difficulty keeping things in order, certain parts of the environment become security risks. An ordinary kitchen, for example, can be extremely dangerous to an individual who could confuse the use of the oven, cupboards, refrigerator and freezer. The design of these areas requires particular attention. The common kitchen should not only be designed for safety; it should also be large enough and laid out in such a way as to accommodate several people working together.

The clustered home should be planned as a permanent home integrated into an ordinary housing environment, where residents can be close to their relatives and remain within their established social networks and close to their memories. However, to eliminate confusion, several clustered homes should not be placed close together, and activities for outsiders should not be offered in the home itself.

Residents, on the other hand, should have ample opportunity for activity. Since people with dementia often reverse night and day, it is important that organized, common daytime activities be available to help them establish and maintain a normal daily rhythm. This is one of the ways in which the common areas play a critical role. Cooking, setting the table, washing up, reading papers, doing handicrafts and memory training are common activities of great therapeutic value that occur naturally in these areas. Because the physical environment can also be therapeutic, furniture and furnishings in the common areas should belong to the residents or at least remind them of old lifestyles or former times. ▲

PART THREE

Enhancing Independence Through Support Services, Transportation and Technology

CHAPTER 12

Enhancing Independence Through Support Services

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There is growing recognition in Canada and other countries that people with disabilities wish to live as independently as possible in familiar surroundings — their own homes or neighbourhood. Governments, housing organizations and non-profit agencies are beginning to initiate strategies and programs, including the building of more appropriate and sensitive types of accommodation. Health and social service organizations and agencies responsible for the delivery of support services are also working to improve accessibility to a wider range of community-based support services. This combination of housing options and support services can be a major factor in enabling people with disabilities to achieve their goals.

The range and types of services available can vary widely in different parts of Canada. Sources of information on services include organizations representing people who have disabilities; provincial and municipal health, welfare and social services agencies; and voluntary organizations. The following are some of the types of services available:

__Meals__ — in shared-housing schemes, provided by on-site staff.

__Emergency Response Systems__ — used to link people in their homes to central monitoring agencies, fire and medical personnel or staff offices. Users can initiate calls (by touch or voice), and some systems are activated immediately when a fire breaks out.

__Homecare__ — for those who require on-site personal care or homemaking services.

__Attendant Care__ — usually associated with the building that is home to people with disabilities, where individuals live in their own apartments but have access to 24-hour attendant care (see the description on Cheshire Homes, page 135). However, attendant care can also be delivered in different ways. For example, the Edmonton Residential Aide Placement Service Society, a non-profit organization funded by Alberta Family and Social Services, assists people with physical disabilities who are living in their own homes to obtain government funding. With this funding, they can hire a personal care attendant to provide for their daily needs. People who require more care than is available in their housing project may also access this funding to purchase their own care and use the project's services as a back-up. Also in Alberta, direct funding for persons with disabilities living in the community is provided by the province's Income Support Program through its Social Allowance for the Disabled component. Eligible individuals use these funds to contract with community-based agencies for the services they need.

In addition to these more common support services, a number of new types of services have emerged recently. Many of these initiatives have been outlined with the housing options featured in previous chapters. However, a few are described in this chapter: the Independent Living Centres, Cheshire Homes, the Barrier-Free Design Centre, the Technology Centre at Ten Ten Sinclair and the Disabled Persons Housing Service's assessment/training flat.

Independent Living Centres

The Independent Living Movement promotes individual control, self-determination and integration for people who are disabled. To put these principles into practice, independent living centres, which are consumer-controlled and community-based, have been established across Canada. Through these centres, people with disabilities are shown how to take responsibility for developing and managing personal and community resources, wherever they choose to live. Staff at the centres provide assistance, counselling and services not already found in the community, with the primary objective of helping people with disabilities to control their own lives and to integrate into society. Those who can already manage their own assistance, those who could do so with more fully developed skills, and those who are unable to direct their own assistance can all benefit from the types of comprehensive, community-based services offered at an independent living centre.

The essential program components are information and referral, peer counselling, individual advocacy, demonstration programs, service delivery and co-ordination, housing assistance, attendant care, transportation, technical aid loans, service networking, and assistance with problem-solving. ▲

Cheshire Homes

Recognizing the right of young physically disabled adults to live independently in their own accommodation and in the community, the Cheshire Homes Foundation works with local concerned citizens to provide housing and support services. A network of Cheshire projects exists worldwide. In Ontario, Cheshire's 23 housing projects include a combination of small group homes and accessible units in regular apartment buildings. Support services are also provided on an outreach basis to people living in their own homes.

The types and levels of support assistance required by people with disabilities living in a Cheshire project vary. However, the types of services that could be available include the following:

Attendant Care — initiated and directed by the person who is disabled, this involves providing assistance with personal hygiene, grooming, dressing and undressing, transferring and positioning, meal preparation and feeding, and housekeeping.

Life Skills and Transitional Training — this involves learning and practising the skills necessary to live and participate in the community: effective communication, personal finance management, maintaining health, assessing and arranging for assistance, developing effective relationships, using community resources and health networks, and creating a lifestyle that is personally satisfying and respectful of others. ▲

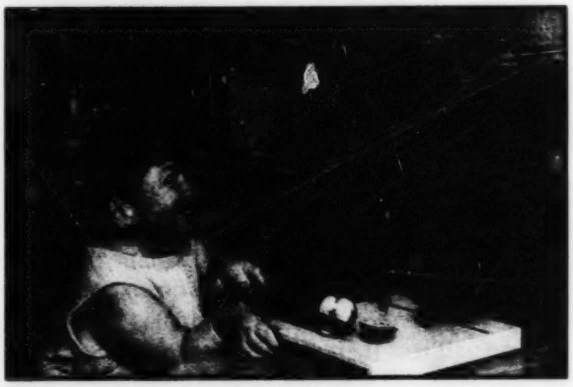
Barrier-Free Design Centre

The Toronto-based Barrier-Free Design Centre is dedicated to making the built environment more accessible and usable by all people, including those with disabilities. To do this, it provides various services on barrier-free design and construction and on building products, including direct consultation, site visits and building assessments, design and construction recommendations, and plan reviews. Education seminars ranging from awareness to technical subjects are made available to contractors, building and design officials, health and social service groups, and people with disabilities.

The centre also develops publications and practical tools, such as the *Sourcebook: Architectural Guidelines for Barrier-Free Design*, the *Directory of Barrier-Free Building Products* and the Wheelchair Access Drawing Template, which can prove invaluable to those who are involved in the design of new housing or the renovation of existing accommodation. ▲

The Technology Centre at Ten Ten Sinclair

At Ten Ten Sinclair (see page 107), there is a technology centre which is actually a converted one-bedroom suite loaded with all sorts of technologies designed to help people with disabilities live independent lifestyles.



216 Cutting fruit is easy with this knife.

217 Serving a hot drink, using this kettle-tilting device.

Through a tenant lending arrangement, tenants can borrow a variety of technologies that have already been developed, for trial in their own homes. Available devices include a special extended chair that enables a person with

218
A transferring board is used to transfer items from the oven to the countertop.

219 A reacher makes it possible to obtain items from high shelves.

220 Some of the devices available at the centre.

disabilities to transfer from a wheelchair to a bathtub; a chair for the bathtub with a seat that moves up and down (for lowering a person into the water); can and bottle openers; microwaves and wall ovens; bed-to-wheelchair transferring boards; grab bars (for trial in different locations and at various angles); and reachers to access distant objects.

The technology centre at Ten Ten Sinclair is a unique experiment that is proving its worth every time persons with disabilities are able to find an instrument or piece of equipment that will enhance their ability to live independently. It is an experiment that could well be duplicated by the private and non-profit sectors and applied at the local level in other communities. ▲

The Assessment/Training Flat: An English Example

The Disabled Persons Housing Service, an arm of the Walbrook Housing Association in Derby, England, provides housing and building design advice to those whose housing needs are complicated by a disability (see also page 38). One of the tools used in assessing an individual's needs and preferences is an assessment/training flat (apartment). In this apartment, the abilities of individuals are assessed by an occupational therapist. They are then counselled on the type of equipment and facilities best suited to their particular capabilities and trained extensively on how to manage household tasks (using equipment and aids if necessary) so that they can live independently. Another function of the apartment is to show people how best to manage their care package.

In designing the assessment/training flat emphasis was placed on making it as flexible as possible rather than creating a homelike environment. In its large bathroom, the toilet can be accessed from all sides and the shower can be used with either a fixed or portable bath chair, or from a standing position. The heights of the kitchen work surfaces and sink can be adjusted, and various stoves and ovens can be tried out. A track hoist over the bed allows critical measurements to be taken so that the correct specifications can be prepared for the adaptation of the client's own dwelling.

221 Because the countertop and sink in the kitchen have been fitted with a cranked handle, the occupational therapist is able to adjust their height to suit the individual user.

222 These two devices enable people who cannot use their hands to prepare and drink a hot beverage, by applying foot pressure against a spring.

In order to assess their needs properly, clients occupy the training flat for short periods, handling the equipment that has been set up and working with the advisers on creating or adapting aids for their use. The training flat is invaluable in helping advisers to make accurate practical assessments of their client's housing needs, and the results of these assessments are used for design purposes. For example, bathrooms in their homes are designed so that clients can bathe alone without the need for an attendant's services, and kitchens are designed so that they can prepare their own meals. ▲

CHAPTER 13

Enhancing Independence Through Transportation

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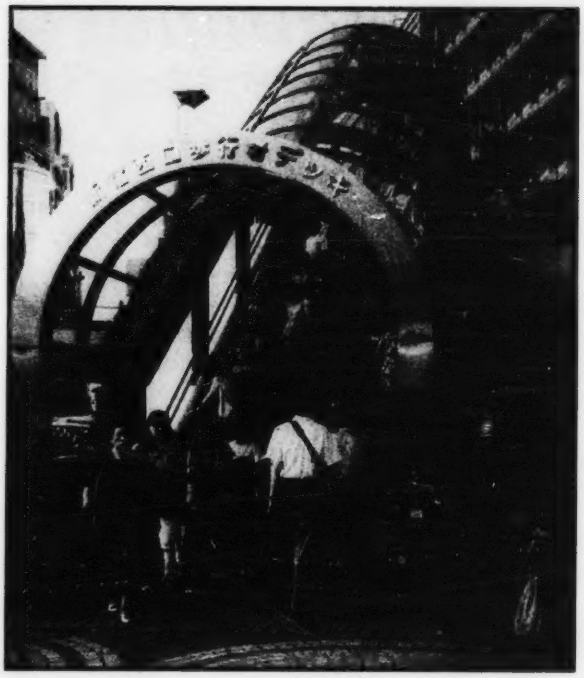
Accessible transportation is essential to quality of life for persons with disabilities. It not only offers greater freedom and independence, but also encourages participation and full integration into the community.

Recent development and promotion of completely accessible taxis, vans and buses by governments, transit companies and manufacturers around the world is going a

223a The Mitsubishi-developed escalator with steps that convert into a deck to accommodate a wheelchair.



223b The Shinjuku subway station is wheelchair-accessible, thanks to a specially designed escalator.

long way toward providing to improved transportation and travel opportunities for seniors and persons with disabilities. For example, in Canada, financial backing by Transport Canada has resulted in the development and testing of several prototype designs for a taxi vehicle, taxi-van and inter-city coach bus.

Provincial, regional and municipal governments have also implemented several initiatives to make their cities more accessible. In Tokyo, Japan, for example, an escalator whose steps can turn into a deck to accommodate a wheelchair or baby stroller is providing access to the Shinjuku subway station. Cambria County, Pennsylvania, in the United States, has implemented a fully accessible public transportation system; pedestrian crossings in the United Kingdom are being fitted with devices that allow blind and visually impaired people to control the traffic light sequence and receive an audible warning of imminent changes in the signal so that they can cross the streets safely; in Cologne, Germany, bus drivers and taxi drivers have worked out a co-operative system whereby bus drivers will call cabs for passengers getting off at bus stops in the evenings; and the British Columbia Transit Commission, in Canada, has initiated a program that has put a total of 217 wheelchair-accessible vehicles on the roads over the last year. Some of these initiatives are described in this chapter.

Transport Canada's Initiatives in Transportation

Montréal's Accessible Taxi Vehicle:

A prototype taxi vehicle that looks like a small van and can accommodate wheelchair users is being tested by a Montréal-area taxi company on behalf of the Montreal Urban Community Transit Corporation. Developed jointly by Transport Canada's Transportation Development Centre and GSM Production Inc of Saint-Laurent, Quebec, the versatile vehicle can be used commercially or as a family vehicle and can seat people with and without disabilities.

224 Montréal's accessible taxi.

Ottawa's Taxi-Van:

Specially equipped taxi-vans designed for persons with disabilities are being used in Ottawa by the Blue Line and A-1 taxi companies. Ottawa first received the modified mini-vans as part of a two-year pilot study to assess their performance within a regular taxi service in a Canadian climate. The taxi-vans are now available for persons with disabilities through the regular taxi service.

225 Ottawa's taxi-van.

Accessible Vehicle Acquisition Program:

Public or private organizations wishing to provide a transportation service in a small urban or rural community (of fewer than 10 000 persons) for persons with disabilities can receive funding through Transport Canada's Accessible Vehicle Acquisition Program. The maximum funding available is 80 percent of the purchase price, to a maximum of $25,000, of a vehicle properly equipped for the transportation of persons with disabilities. Accessible features of such a vehicle could include larger door openings, lower floor and step heights, careful placement of grab rails, wheelchair lifts and tie-downs, and improved visual and audio information systems.

226 An accessible bus.

Canada Coach Lines Accessible Intercity Service Demonstration:

Six specially equipped intercity buses accessible to persons who use wheelchairs went into regular service in October 1989 in a demonstration sponsored by Transport Canada and operated by Hamilton-based Canada Coach Lines. Each bus is equipped with a lift and two wheelchair tie-down stations. The buses are on a three-year trial on a five-city run: Kitchener-Cambridge-Hamilton-St. Catherines-Niagara Falls. To help those persons with mobility problems who do not use a wheelchair, a transfer-chair service is available at the five bus terminals. The project is a major stepping-stone toward the provision of better travel opportunities for those Canadians who have difficulty boarding intercity buses. ▲

227 Canada Coach Lines' wheelchair-accessible bus.

Fully Accessible Intercity Bus

With federal government support, Motor Coach Industries of Winnipeg has developed a prototype 14 metre bus incorporating innovative design and engineering features that make it fully accessible to travellers with disabilities. This accessible intercity bus — the first of its kind in the world — has the following state-of-the-art features: a self-contained modular hydraulic wheelchair lift with a canopy door for protection, space for four wheelchairs, and an accessible washroom with a toilet that swivels and a water faucet that is automatically activated by an infrared sensor. Improved heating, ventilation, air-conditioning and suspension systems provide comfort for all passengers. ▲

228
The hydraulic wheelchair lift and canopy door are among the innovative features of Motor Coach Industries' prototype intercity bus.

229
The washbasin slides out to enable people to use it from a seated or standing position.

Accessible Transit Service in Cambria County, United States

The Cambria County Transit Authority, in Johnstown, Pennsylvania, transports more wheelchair users per bus than any other transit system in the United States. All the buses used for both the urban and rural divisions are accessible to wheelchair users, and the transit authority has developed a comprehensive program to educate potential users about the system, including the wheelchair lift.

A fleet of 27 advanced buses operate on 14 fixed routes in the urban area. A combination fixed route and call-on-demand system is operated for the rural area, which encompasses 750 square miles. The mid-sized buses are used on the fixed route, while an accessible vehicle is dispatched (on 24 hours' notice) for people who do not live along the fixed route. ▲

JOHNSTOWN
204

230 Disembarking from a wheelchair-accessible bus in Cambria County.

British Columbia (B.C.) Transit's Initiatives

In conjunction with the Committee to Promote Accessible Conventional Transit, B.C. Transit initiated its Wheelchair Accessible Bus Program in the fall of 1990. Implemented in phases, the program was begun with 86 lift-equipped vehicles, which operated on 22 bus routes throughout the Vancouver area. By the end of 1991, B.C. Transit had 217 wheelchair-accessible vehicles on the road, which provide scheduled service on 47 routes. It is expected that an additional 73 accessible vehicles will be put into service during 1992.

The accessible urban- and suburban-style diesels, articulated buses, small buses and mini-buses represented 24 percent of B.C. Transit's entire fleet at the end of 1991. Vehicle types are matched to specific routes that are considered suitable for wheelchair-accessible service (based on the market being served and the level of demand). Regular schedules have been assigned to the vehicles being used and the routes being served. In addition, B.C. Transit has developed a standard design for a bus stop that provides adequate space for a wheelchair user to manoeuver on and off a lift platform, and ensures the safety and efficiency of on-street traffic operations. ▲

231 A passenger using a wheelchair exits an accessible bus.

CHAPTER 14

Enhancing Independence Through Technology

With the rapid advancement of computer and electronic technology, a wealth of products designed to offer convenient, secure and efficient control of the home environment will become available to the general public within the next few years. While the average homeowner might delight in these new "toys," for people with physical disabilities new technology may help to open up exciting, new opportunities for independent and active lifestyles.

While many innovative technologies are still in the prototype stages, useful products are starting to appear in the marketplace, and the prospects are good for more and more products that will benefit people with disabilities. It is only a matter of time before manufacturers will be offering a wide selection of effective solutions to some of the everyday problems faced by people with disablities.

This three-part chapter outlines some developments in low technologies, robotics and automated homes that are of particular interest to people with disabilities.

Low Technologies

It is often the little things that count for so much. While low technologies — small-scale products, often computerized, that tackle one or two physical challenges faced by individuals with disabilities — may not have the same pizzazz as a robot or an automated building, their potential usefulness in enhancing the lifestyles of those with some disability is unquestionable.

A few of these low-technology products are described in this section: the wheelchair that gives the lawn bowler who has a disability an opportunity to compete again; the Tongue-Touch Keypad that enables people who are quadriplegics to control their environment; the talking newspaper that enables blind people to keep in touch with current events; and the human-factors designed kitchen and ergonomic kitchen that make it easier to prepare a meal.

A Wheelchair for Lawn Bowlers

Lawn bowlers with disabilities can compete on virtually equal terms with other bowlers thanks to a wheelchair designed specifically for this purpose. The Bradshaw Bowls Buggy, manufactured by Bradshaw Engineering in the United Kingdom, has wide, solid wheels made of low-friction plastic and a special speed-control propulsion system instead of brakes. This new chair enables the person with disabilities who has a fondness for the "green" to access the entire playing surface — a capability impossible with a traditional wheelchair. ▲

232 Back on the green again.

• •

The Tongue-Touch Keypad

Imagine the 2.5 million people in the world who are quadriplegics being able to control lights, turn on the television and operate their telephone, bed and motorized wheelchair with computer keys housed in a simple orthodontic retainer complete with a battery-operated transmitter! What was once considered inconceivable is closer to being realized with the recent development of the Tongue-Touch Keypad.

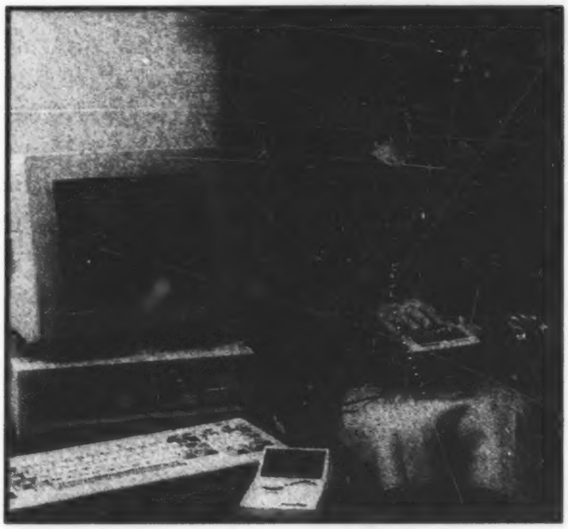
The brainchild of Zofcom Control System in the United States, the device, weighing less than an ounce, sits, like a dental retainer, in the roof of the operator's mouth. It is equipped with nine small buttons and uses radio frequency and infrared technology to provide users with wireless control of their environment. ▲

233 A student with muscular dystrophy and an occupational therapist work with the Tongue-Touch Keypad during a class at Foothills College, in Los Altos Hills, California.

234 The Tongue-Touch Keypad and a model of the upper palate.

Talking Newspapers for Blind Persons

Great Britain's Royal National Institute for the Blind has developed a new system that will enable people who are blind to "read" or listen to instant digital versions of the country's daily newspapers. The system, currently on trial, works this way: text is transmitted digitally on the television network and accessed in the homes of people who are blind through an authorized screen electronics decoder card in a personal computer. The decoder enables them to "read" the latest news by means of either a speech synthesizer or a transient braille display. ▲

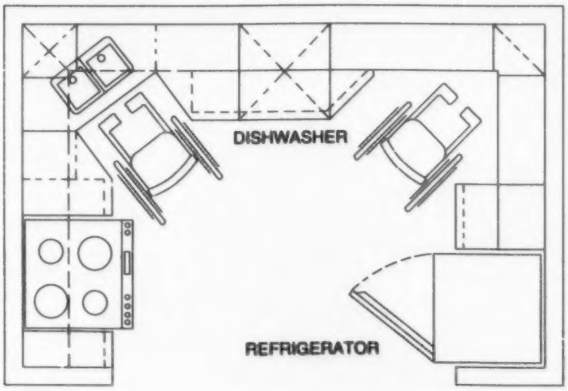


235 A blind woman is able to "read" the latest news using a speech synthesizer.

The Human-Factors Designed Kitchen

Using data on people's varying abilities to negotiate their environment, Advanced Living Systems in the United States has created a new line of kitchen units that are flexible and adaptable to all ability levels. This Lifespec Cabinet System is not only practical in terms of its ease of use and efficient use of space, but it is also aesthetically pleasing.

Each unit in the modular kitchen has been designed to accommodate a range of client needs. All the cabinets and cupboards feature adjustable shelving. The height of the cabinets, countertops, sinks and stove can also be adjusted, and clear space can be created under the stove and countertops to allow for easy access by wheelchair users.



236 The sink and pantry are located in the corners of the room to achieve the best use of space and enable users to turn easily to adjacent work areas. A continuous countertop between the sink and the stovetop facilitate sliding rather than carrying utensils from one to the other.

237 Wheelchair users can move the chair right up to the sink, and other people can use the swing-out seat.

The basic U-shaped kitchen affords ready access to all equipment and storage areas and enables users to avoid excessive movement. For example, the stove and sink have been placed close together to minimize carrying distances. Non-glare cabinets are strategically located to reduce the likelihood of scalding or fire. A pull-out seat under the sink eliminates the need to stand while working for long periods of time. ▲

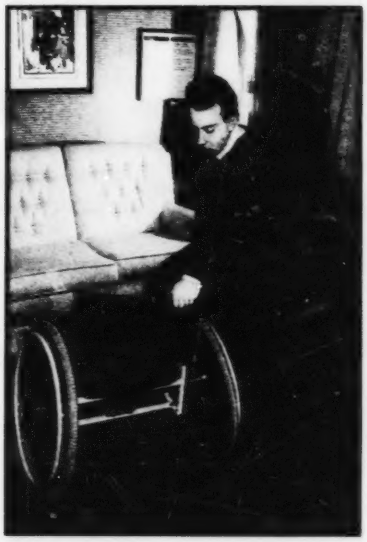
238 The corner pantry features shallow, adjustable shelves up topand a combination of shelves and pull-out drawers at the lower level.

The Window on Technology Centre

The Toronto-based Window on Technology Centre, an initiative of the Ontario Ministry of Community and Social Services, is a showcase of creative designs and new technologies that promote and support independent lifestyles for seniors and persons with disabilities. People can see for themselves the range of devices, furnishings, equipment and other products available on the market and how a home can be made more safe, barrier-free and enjoyable.

Among the products and low technologies on display at the centre is an ergonomic kitchen with motorized adjustable countertops and cupboards. By combining the principles of ergonomics — adapting the environment to the person rather than having the person adapt to the environment — and adaptability, a number of European and North American companies have designed kitchens that can be quickly adapted to meet a variety of individual needs and preferences.

Ergonomic kitchens incorporate features such as pull-out work surfaces; open spaces below counters, stovetops and sinks; flexible piping so that sinks can be raised or lowered; shallow or sloping sinks; taps with extended lever handles; drawers that pull out all the way; and pull-out pan drawers under stoves. ▲



239 A hydraulically powered reclining chair facilitates transfer to and from a wheelchair.

240 A motorized adjustable countertop in an ergonomic kitchen.

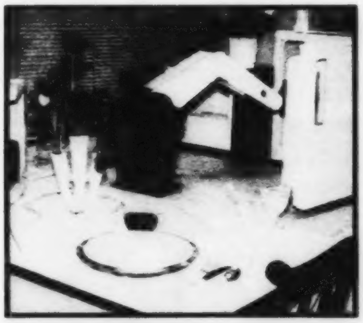
Robotics

The robots being developed these days may appear less formidable than the space-age robots that dominate the movie screen. However, some of the tasks they have been programmed to perform are just as futuristic. More robotic systems than robots, these types of equipment can be programmed to perform a multitude of tasks that most of us take for granted. They can prepare a meal, hold a handkerchief to a nose, put food away in the cupboard or fridge, pour drinks, answer the phone, insert a disk into a computer and even tidy a desk.

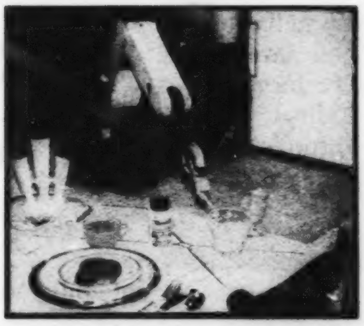
The four pieces of robotic equipment described in this section — a robotic arm, a finger-spelling hand, a desktop robot and a robotic assistive appliance — do many of these tasks and are invaluable to the people with severe disabilities who are fortunate enough to have them. For these people, modern-day robotics is demonstrating that high-level technology can be applied in an effective, immediate, yet human way to their particular needs.

The Robotic Arm that Can Make Breakfast

Think about it: a voice-activated robotic arm that can take food out of the refrigerator, place food in the microwave, pour a drink into a cup, measure sugar for your coffee and set food out on the table! Thanks to the research



241
Removing food from the refrigerator.



242
Measuring sugar into a cup of coffee.

243
Setting food on the table.

efforts of Ms. Engelhardt, director of the Centre for Human Service Robotics at Carnegie Mellon University in Pittsburgh, Pennsylvania, "service robotics" of this type may very well find their proper place in the homes of many people with disabilities.

Service robotics not only help people perform a multitude of daily living tasks; because they can make homemaker services more effective, they can also contribute to a more cost-effective delivery of health care and social services. In some cases, robotics devices should make the difference between whether a person must receive care in an institutional environment or can live independently at home.

A human robot, such as the voice-activated robotic arm, can be designed to perform a range of tasks, including fetching, carrying, lifting, transferring, monitoring vital signs and feeding. ▲

Dexter II: A Finger-Spelling Hand

For the estimated 2,000 Canadians who are both deaf and blind, a special mechanical hand that acts as a human interpreter has the potential to open up exciting new opportunities. By using the Dexter II, deaf-blind people, often isolated because of their disability, can learn to communicate easily with others, without having to rely on expensive and hard-to-locate human interpreters who are familiar with the finger-spelling technique.

Developed by the Department of Veterans Affairs Medical Center (DVAMC) in California, Dexter II is a communication device that allows deaf-blind users to independently receive information from several sources, including telephones, computers and face-to-face conversation with people unfamiliar with finger-spelling. The mechanical hand's finger movements correspond to the one-hand finger-spelling alphabet already widely used by deaf people. To communicate, the deaf-blind person touches the mechanical hand as it moves and translates the finger positions into the letters of the message. The messages themselves can originate from one of several sources used by a person without disabilities: a keyboard, a computer system, a Telecommunications Device for the Deaf (TDD) or a modified closed-captioned device for the deaf. Dexter can also be used with a TDD to provide deaf-blind people with telephone communication and can be connected to computers to provide job opportunities.

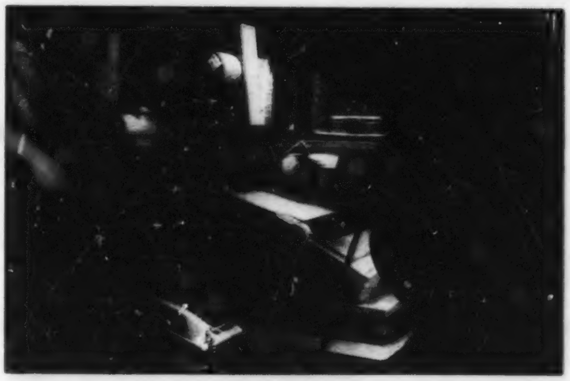
244 Dexter II.

Dexter II is a prototype at the moment and not available on the market. The Gallaudet University, in Washington, D.C., is funding DVAMC to build two enhanced prototypes for evaluation by deaf-blind persons, a necessary step toward commercialization. ▲

The DeVAR (Desktop Vocational Assistance Robot) Workstation

Developed by the Department of Veterans Affairs Medical Center in Palo Alto, California, the DeVAR workstation is making it possible for people with high-level quadriplegia to independently perform daily living and vocational tasks in an office environment. By virtually eliminating the need for an attendant for an extended period of time, the DeVAR workstation is enabling employees with quadriplegia to continue working. Attendants are used only for set-ups and emergency tasks. This type of robotics technology is also proving to be cost-effective.

The DeVAR workstation works by voice command and can perform a combination of daily living tasks in the workplace: getting a drink, giving medication, scratching a nose and serving lunch. Vocational tasks that it can carry out include answering the phone, loading a disk into the computer and tidying up. ▲



245 The DeVAR pours a drink.

The Robotic Assistive Appliance

The Robotic Assistive Appliance is Canada's answer to the need for a robot to help people with severe disabilities with tasks in the home or at work. Its development by the Neil Squire Foundation has enabled people to perform tasks that they were unable to do before, such as turning the pages of a book, manoeuvering objects, serving coffee and brushing their hair.

The appliance, or arm, is operated and controlled through a computer. Simple English commands are chosen by the user from a menu on the computer screen. The system can be operated through voice recognition, morse code, keyboard or scanning. ▲

246 Turning the pages of a book using the Robotic Assistive Appliance.

Automated Homes

The homes described in this section represent some of the most advanced developments in home automation. Filled with a wide array of technological devices and aids, these dwellings use sophisticated wiring and remote control systems to enable the occupants to control many components of their living environments and improve their quality of life. This technology could be of particular benefit to people with disabilities.

The development of automated building technology is proceeding in many countries. The examples described in this chapter illustrate a wide variety of approaches from Denmark, France, the Netherlands, Japan, the United States and Canada.

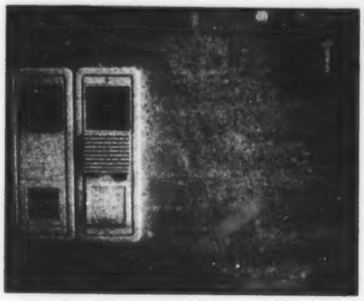
The Electronic Dwelling in Denmark

Envrionmental Control Devices (ECDs) can help people with physical disabilities assume and maintain enjoyable and independent lifestyles. When a home is equipped with ECDs, many functions can be performed by remote control: for example, answering the front door, calling for help in an emergency, controlling lights, and opening and closing windows. In Denmark, researchers believe that ECDs should be installed only when they are required and that the use of such devices must be assessed in relation to the particular situation and needs of an individual. To ensure that dependence is reduced, each device must carry out a desired function in response to a concrete need.

247 An aerial view of the two-storey apartment building in Odense, which contains the Electronic Dwelling.

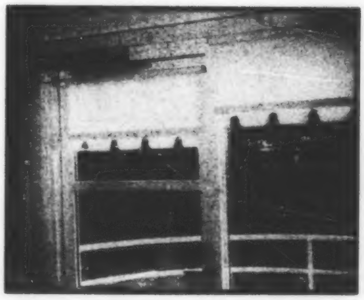
The Electronic Dwelling, created with this principle in mind, is located in a two-storey apartment building for seniors in Odense. In this apartment unit, 11 ECDs — including an electronic door opener, window blinds, ventilation and lighting controls and an audio-video peep hole at the front door — have

248 Examples of ECDs in the Electronic Dwelling:



1) Electronic locks, door opener and video camera.

2) Window blinds activated by remote control.



3) Remote-controlled balcony door.

4) The heights of the oven and stovetop can be adjusted electronically.

5) The air extractor is activated by infrared sensors.

6) The two-way emergency response system, placed behind the telephone, can pick up sounds from throughout the apartment when activated.

been installed. Most of the electronic devices are activated by a hand-held, infrared, remote control device. The experience of the occupant, who relies on a wheelchair to get around, is proving invaluable in assessing the value of the various ECDs to people with similar disabilities. Although only one apartment is currently outfitted with ECDs, all the apartment units in this building have been pre-wired to permit easy installation of ECDs.

The Danish Building Research Institute, which has been monitoring the usefulness of ECDs in homes, has concluded that the starting point for choosing a particular electronic device must be the expressed need of an individual who requires a specific support to carry out a desired function. Nevertheless, because ECDs can be useful in most cases, it is advisable, when building homes intended for seniors and people with disabilities, to have all the homes pre-wired for such devices. ▲

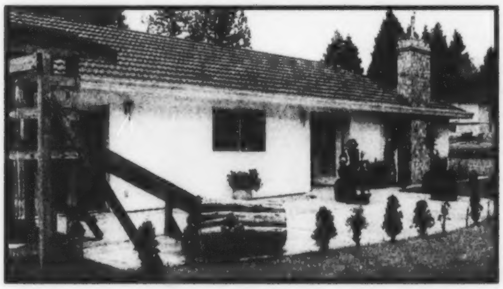
Larry Boden's House: A Canadian Model in Home Automation

When a car accident left Larry Boden a quadriplegic with no movement from the neck down, he realized that if he was to resume an independent lifestyle he would need a special house to accommodate his particular needs. While still in the G.F. Strong Rehabilitation Centre, Larry used a mouthwand and a computer-aided drafting program to design a beautiful Spanish-style home in a suburban community of British Columbia.

Larry's goal was twofold: to provide easy physical access and to maximize independence. Ramped entrances and paved walkways posed a minor challenge, but the real task lay in developing communication software that would enable a computer to control electronic devices and household appliances. The Neil Squire Foundation worked with Larry to implement a home automation system. Pre-wiring the house for such a system has allowed new technologies to be readily incorporated as they became available. In this way, Larry has been able to customize the system to meet his own needs.

A mobile remote-control system and simple command structure developed by the Foundation enable Larry to access the technology. A wheelchair-mounted liquid crystal display (a small display capable of showing text or video information) portrays a voice-activated menu so that he can control any electrically operated device — the telephone, television, VCR, front door, lights — from wherever he is in his home. This "Remote Gateway" has been programmed to respond to Larry's voice with commercially available voice-recognition technology. Larry's voice command is picked up by a small microphone, which is usually clipped to his shirt, and transmitted through a wireless link to a base station near his computer. "Wake up" brings the computer to life, while "go to sleep" prompts the computer to ignore his voice so that he can carry on a normal conversation. Messages are relayed to the heart of the system, the Regenesis Environmental Control Unit, responsible for manipulating the electronic devices and appliances.

249 The home has ramped entrances and paved walkways.



250 The barrier-free backyard.

251 Nicely landscaped pathways enable Larry tomove freely around his yard.

252 The "Remote Gateway" — a liquid crystal display with voice-activated menu — small headphone (near Larry's left ear) and mini-microphone.

253 The extra-wide sliding doors with no thresholds.

The equipment Larry uses to harness the technology in his home is no more obtrusive and obvious than a modern stereo system, yet it affords him quality of life he could only dream about before. For example, when he answers the telephone from his wheelchair, a small headphone near his left ear allows him to hear the caller in privacy. If someone knocks at the front door, a simple menu selection allows Larry to call up the image from a camera near the door on his liquid crystal display. Another menu selection unlocks the front door. ▲

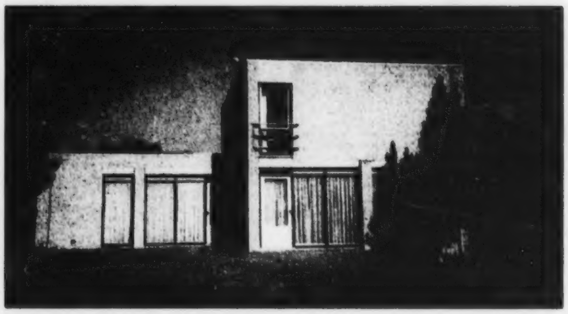
The Intelligent Test-House in the Netherlands

Researchers at the SIGO Foundation in the Netherlands are immersed in an exciting project destined to attract worldwide attention. They are building an Intelligent Test-House in Hoensbroeck, which, when it opens in July 1992, will be a living model of how the quality of life can be improved for many people, particularly seniors and persons with disabilities.

When the Intelligent Test-House is completely finished, it will be used as a "real life" living environment. Ongoing tests of a wide range of technologies, design techniques and devices that have the potential for assisting those with disabilities to live independently in their own homes will be conducted by researchers under realistic living conditions.

The range of products and automated features being considered for evaluation is considerable:

- Safety and security devices (alarms, smoke detectors, overflow protection, social and medical alarms, video intercom, optical bell and boiling indicator)
- Communication aids (including text telephone, computer with peripheral devices, braille line and printer, text scanner with character recognition software and closed circuitry for the auditively handicapped)
- Remote controls for devices and building components (for lights, radio, TV, VCR, windows and doors, curtains and electronic mixing tap)
- Remote control and monitoring of building systems (lighting, heating, ventilation and energy systems)
- Personal care and mobility aids (bed and washbasin with high/low adjustment feature, bathroom lift, adapted toilet and chair lift)



254 The Intelligent Test-House on the grounds of the Rehabilitation Centre in Hoensbroek.

- Housekeeping technologies (adjustable kitchen and cupboards, central vacuum cleaning system)
- Medical aids (monitoring devices, devices for diagnostics and infusion of medication, respiration aids)
- Building design features (such as accessible and barrier-free design and the use of maintenance-free materials)
- Services that rely on telematics (such as tele-banking, -shopping, -education, -work and -information services, and social alarm services)

All these devices and features are designed to meet the needs of a wide clientele, including those with motor disabilities, visual disabilities or auditory disabilities, frail seniors, and people who are ill and being nursed at home. Indeed, the Intelligent Test-House is expected to demonstrate how everybody's living environment can be enhanced by the many devices and features that will be developed and tested. ▲

Future Home: A Living Laboratory of Home Automation in the United States

The purpose of Future Home, a 5000 square foot living laboratory and demonstration area located north of Baltimore, Maryland, is to show how home automation technology can be used to allow people with disabilities to live independently. Formerly a 140-year-old historic tavern, the building, now under renovation, will house a living laboratory of home automation for people with disabilities. A major objective of Future Home is to offer tours of the facilities to designers, the industry, consumers and other interested parties so that they can see for themselves the potential that exists for home automation.

255 From historic tavern to Future Home.

When renovations are completed in the fall of 1992, Future Home will have three components. The main floor of the house will be occupied by curators David Ward (a quadriplegic) and his wife Terry. The second floor will contain an apartment for Ward's caregiver and a laboratory for the development of appropriate electronic hardware and software. Future Home will use both new and off-the-shelf technology to create schemes that offer innovative technical solutions to enable persons with disabilities to live independently.

Five years ago, when Ward and his wife were appointed resident curators, Ward drew up a "wish list" of items that would allow him to live self-sufficiently in his dream home. Many of the items had to be invented. Now, Future Home is proceeding with the co-operation of Volunteers for Medical Engineering (VME), a national volunteer group dedicated to solving the engineering problems faced by people with disabilities, to test and demonstrate innovative technologies for persons with disabilities. The project will feature a wide variety of home-oriented technologies, equipment and devices, including voice control, people tracking, a centrally controlled electronic regulating system for lighting, computerized control for heating and cooling, a special security system, self-adjusting furniture and accessible grounds. VME plans to build and test devices in the laboratory before they are installed downstairs in the Ward's home. To date, VME has already designed a number of devices of interest to persons with disabilities, including a blink switch (to allow a person to operate a computer by blinking), a mobile standing frame and a universal remote controller. ▲

SPACE+: A French Example

SPACE+ is an experimental house in Senlis, France, developed by the Office public d'aménagement et de construction de l'Oise to improve the quality of life of people with physical disabilities. The house operates as a living laboratory where new technologies can be modified and perfected. This arrangement facilitates testing with ongoing tenant feedback — a key to design and manufacturing improvement.

256 A view from the street.

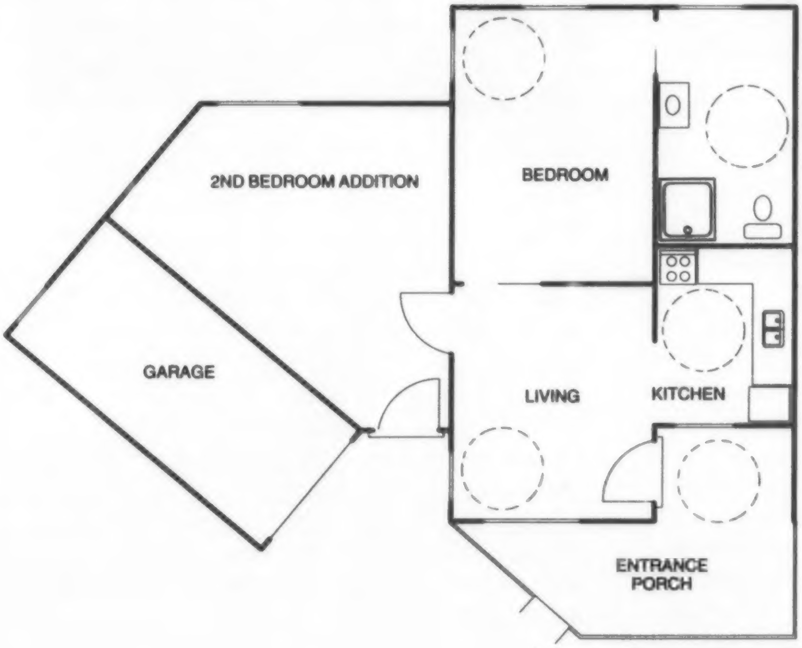
To maximize the use of available space, to allow for larger rooms and to provide for freedom of movement for people who use wheelchairs, corridors and circulation areas have been eliminated from SPACE+. Instead, the unit is organized around a direct-entry living area that communicates directly with the kitchen and bedroom. To increase wheelchair accessibility and mobility within the house, sliding doors were installed between the living area and the bedroom, between the bedroom and the bathroom, and between the kitchen and the living area.

The SPACE+ concept also places emphasis on creating dwellings that are adaptable to the unique or changing needs of the occupants. For example, when a person becomes bedridden, lightweight, easy-to-remove wall partitions make it easy to convert the main bedroom and the living area into a single large room. The occupant gets maximum use out of the space. In addition, the bathroom and bedroom have been fitted with adaptable furniture and fixtures, and the kitchen has motorized adjustable sink and cupboards.

All doors, window blinds and lights are controlled by wireless, pocket-sized, infrared remote-control units, which can be placed conveniently around the house, attached to a wheelchair or carried by an occupant. As well, the potential exists for voice-activated operation of the system with such simple commands as "light" or "blinds." ▲

257 Adjustable sink and cupboards.

258 Automated sliding door between the living area and patio.



259 Floor plan showing where a second bedroom can be added.

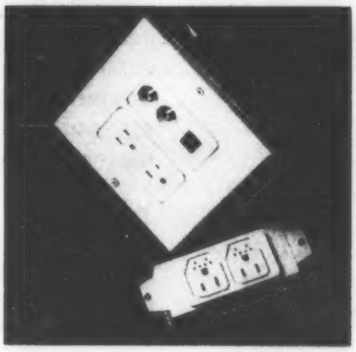
The American "Smart House"

Smart House is an integrated home automation system that enables individuals and families to enjoy a personalized and convenient living environment. Based on a whole-house energy and communications distribution system, Smart House provides easy-to-use, centralized home management with fingertip control. The system's modular design allows for expansion or modification according to changing needs.

Centralized control of all automated features in the home, including security, safety, energy management, entertainment, lighting and communications, is attributed to a revolutionary wiring sytem, semi-rigid gas piping and built-in electronic intelligence. An integrated three-cable system — hybrid branch, communications and applications cables — replaces all traditional wiring currently needed to power household equipment, appliances and other devices, and distributes power and communications throughout the house. The innovative gas piping system enables economical gas service in more locations throughout the house, while a simple mating device in the home's easy-to-connect outlets allows for convenient plug-in of a new generation of gas appliances. Intelligence provided by a System Controller, which co-ordinates all system communication signals, enables compatible appliances and devices to exchange messages and interact functionally.

Some of the features of Smart House design include cable television in every room; single machine VCR output to any television; telephone access in every room; built-in answering service that allows an individual to access phone messages inside and outside the home; and multi-light dimming, automatic control options and power surge protection to prevent damage to the system in the event of a lightning strike or power failure. "House modes" enable users to program a sequence of

260 An example of a Smart House.



261
This modular, multi-service outlet is the access point for power, telephone, control and audio/video services in a Smart House.

262 Hybrid branch, communications and applications cables carry all power, control, telephone and audio/video signals throughout a Smart House.

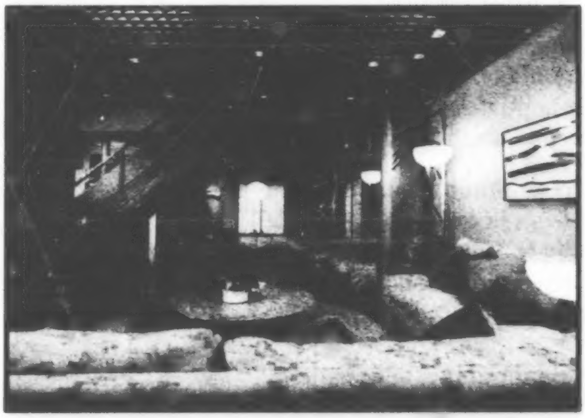
operations in the home. In addition to the three custom modes, which allow users to program the system to their own needs, there are five pre-set modes: vacation, awake, asleep, unoccupied and automatic. High-efficiency equipment and temperature zoning capabilities capitalize on off-peak electrical energy rates and lower heating and cooling costs.

Many Smart House functions and features can be controlled from inside or outside the home via programmable wall switches, control panels and video touch screens or by telephone. For example, a person can turn down the heat before leaving for work in the morning, then call the house from work before starting out for home, thereby turning the heat back on so the house is warmed up. ▲

The TRON Intelligent House: A Japanese Model

The TRON (Real-Time Operating System Nucleus) Intelligent House, designed by Ken Sakamura, an associate professor at the Department of Information Services, Tokyo University, is an experimental prototype of what a future house could be. The house incorporates nearly 1000 computers, and network-connected sub-systems work in harmony to make up a total system that surpasses the sum of individual functions. The fully integrated functions — those operating automatically, those operated by people and those transmitting information — provide perfectly balanced living conditions. A central computer system in the basement monitors and controls the various networks. The computers and machinery, concealed to function behind the scenes, act as unseen helpers; the equipment becomes part of the architecture.

What can the TRON Intelligent House do? Here are some examples: weather sensors on the outside of the roof constantly measure temperature, humidity, air pressure, wind velocity, wind direction, rain and light levels. When a pleasant breeze blows outside, windows open; when outdoor conditions deteriorate,



263 In the TRON house, natural materials abound and lighting can be adjusted to create the right atmosphere for various activities.

264 The garden is equipped with a computerized watering system — concealed pipes and moisture sensors — that supplies all the plants with the right amount of water.

265 The second-floor bathroom is equipped with a health checkup system (see the panel on the right-hand wall).

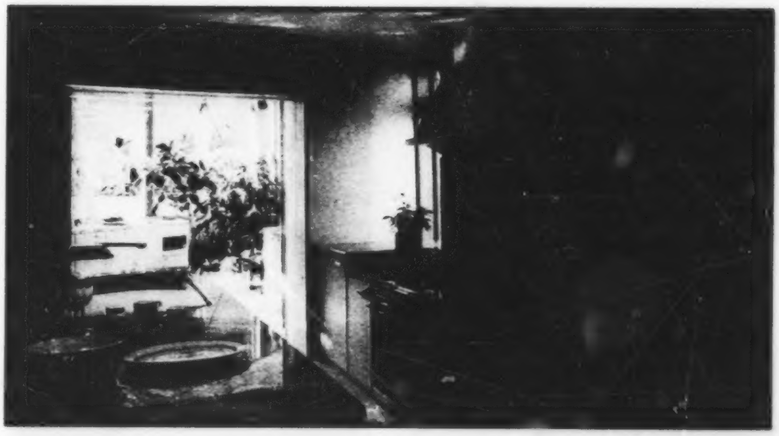
266 The second-floor bathroom includes a cypress bathtub, a built-in video display, waterproof telephone and a multi-functional shower that gives a range of jet streams and massage functions.

windows close and the air conditioning system takes over. Background music is automatically selected to match the lighting mood; when the telephone is answered, the volume of the music is automatically lowered; if someone gets up in the night to use the toilet, "people sensors" turn on subdued lighting in the hallway; skylights are raised and lowered to ventilate the interior.

The potential of this system to improve the lives of people with disabilities is unlimited. Infrared sensors guard against burglaries; heat sensors guard against fire; carbon dioxide sensors monitor indoor air quality. Heating panels in the floor and radiating panels in the ceiling create an even temperature distribution from floor to ceiling. A non-contact toilet on the first floor is designed so that the user never has to touch the toilet. The personal hygiene water-jet facility, taps, faucets and hand-drier are all sensor-operated. The second-floor toilet is fitted with a health checkup system that measures blood pressure and pulse rate and analyzes urine. Information is displayed and then recorded in personal computerized medical records. For long-term health care monitoring, this information can be sent to a health centre by computer or telephone.

In a fully automated kitchen, a computerized guide provides information and advice on ingredients and cooking techniques. A computer-controlled laserdisc video guides the cook, step-by-step, through the processes of food preparation and cooking. The system co-ordinates the oven and cooking rings with the video, controlling temperatures and timings.

Television, music and telephone conversation can be



267
The fully automated kitchen features a sink that has automatic faucets, cooking appliances with automatic ventilation doors, a high-output microwave, ultrasonic dishwasher and vacuum garbage disposal. The barbeque patio behind the kitchen has a fully automated mini-barbeque unit.

enjoyed in every room in the house, even the bathroom. Water temperature and sauna controls for the bathroom can be operated by remote control from anywhere in the house. The strength, temperature, spray pattern and height of the water jet at the washbasin-cum-dressing table can be adjusted at the touch of a switch to provide just the right amount of water for shampooing hair or brushing teeth.

The computerized archive, with under-the-floor storage system, minimizes the need for conventional storage closets and is particularly promising for people with physical disabilities. Riding a small elevator, storage containers are conveyed to or from four access ports on the first and second floors. Container contents are photographed by an electronic still camera whenever an item is retrieved or stored. An inventory list of each container can be displayed on a TV screen.

When all the residents leave the house, an "away" switch is pressed to activate the built-in security controls. The lights in the front lobby turn off and the house is put on security alert. ▲

268 One of the automatic storage containers used in the computerized archive storage system.

CREDITS

1, 2, 3, 4. CMHC. Courtesy of the Osbornes, Brampton, Ontario

5, 6, 7. Brian Williamson, CMHC, Winnipeg, Manitoba

8. Courtesy of the Independent Living Resource Centre, Winnipeg

9, 10. CMHC. Courtesy of Mrs. Marguerite Chown, Winnipeg

11. Courtesy of Lifeline Canada

12, 13. Courtesy of Joe Lobko, Jurecka Lobko Tregebov Architects, Inc, Toronto, Ontario

14, 15, 16, 17, 18. CMHC. Courtesy of Dr. Harry Himal, Toronto, Ontario

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24, 25. Courtesy of Professor Bente Lindström, School of Architecture, Aarhus University, Denmark

26, 27, 28, 29. Courtesy of Jan Paulsson, School of Architecture, Chalmers Institute of Technology, Sweden

30. Courtesy of the Swiss Centre of Building for the Handicapped, Zürich, Switzerland

31, 32, 33, 34. Courtesy of Mme J. Reutemann-Ensslin, Neunkirch, Switzerland

35, 36, 37, 38, 39, 40. Courtesy of Mademoiselle Danielle Chounet, Direction de l'habitat, Ministère de l'équipement, du logement et des transports, Paris, France; et Monsieur Jean-Pierre Maillot, architecte, Saint Quentin, France

41, 42, 43, 44, 45, 46, 47. Courtesy of Mademoiselle Danielle Chounet; et Monsieur Jean-Marc Desnoe, Délégation départementale de l'Agence Nationale pour l'Amelioration de l'Habitat (ANAH), La Mayenne, France

48, 49, 50, 51, 52. Courtesy of Richard Kendall, Disabled Persons Housing Service, Walbrook Housing Corporation Ltd, Derby, England

53. Courtesy of Alberta Municipal Affairs

54. Jeff Barber, Infocus. Courtesy of the Capital Region Housing Corporation, Victoria, B.C.

55. Courtesy of the Capital Region Housing Corporation, Victoria, B.C.

56. CMHC. Courtesy of Société Logique, Montréal, Quebec; and Pierre Richard architect, Montréal

57a, 57b. Courtesy of Ms. Bodil Westrup, Bolig-, Motor-og Hjælpemiddeludvalget, Copenhagen, Denmark; and Poulsen og Therkildsen, architects, Aarhus, Denmark

58, 59, 60. Courtesy of Professor Bente Lindström; School of Architecture, Aarhus University

61, 62, 63, 64, 65. CMHC. Courtesy of Villa Royale, Portage la Prairie, Manitoba

66, 68, 69, 70. Bill Cadzo, CMHC, Ottawa, Ontario

67. Courtesy of John Hix Architects Ltd, Toronto

71, 72, 74. CMHC. Courtesy of Ms. Pat Israel, Toronto

73. Courtesy of architect Robert Topping; and the Barrier-Free Design Centre, Toronto

75, 77. Courtesy of the Norwegian Building Research Institute, Oslo

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76. Svein Erik Dahl, Samfoto A/S, Oslo, Norway

78, 79, 80, 81. Courtesy of CMHC Charlottetown Branch Office, PEI

82, 83, 84. Courtesy of Marshall Homes, architects & builders; and Pope & Wrightson, design consultants for Barrier-Free and Safe Environments, Wellington, New Zealand

85. Courtesy of Grete Bull, Norwegian Building Research Institute, Oslo

86, 87. Courtesy of architect Jon Christopherson, the Norwegian Building Research Institute, Oslo

88, 89, 92. CMHC

90, 91. Courtesy of the Thunder Bay Non-Profit Housing Corporation, Thunder Bay, Ontario

93, 95, 96, 98. Courtesy of Barrier-Free Environments Inc, Raleigh

94, 97. Courtesy of Barrier-Free Environments Inc, Raleigh, North Carolina, USA; and designer James A. Bostrom

99. Courtesy of Interfaith Homes Corporation, Toronto; and architect Blandford Gates of Fliess Gates McGowan Easton Architects Inc, Toronto

100. CMHC

101, 102, 103, 104. Courtesy of The Housing Corporation, London; The Hyde Housing Association, Kent; and Architect Ian Morton Wright, Greenwich, England

105, 106. Courtesy of the Nova Scotia Department of Housing, Halifax, N.S.; and architect Henn A. Soosaar

107, 108, 109, 110. Courtesy of Vim Kochhar, founding chair of Rotary Cheshire Homes Inc; and architect Juergen H. Rust, Toronto

111, 112. Courtesy of the Vasey Housing Association; and Peter Dalton, PTY Ltd, Architects and Social Planners, Sydney, Australia

113, 114, 115, 116, 117, 118. Courtesy of Norman D. Haw of the British Columbia Paraplegic Association; and architect Ben Ostrander of R.B.O. Architecture Inc, Vancouver

119, 120, 121, 122, 123. Courtesy of Mike Donnelly, Development Manager, Habinteg Housing Association Ltd, London, England

124, 125, 126. Courtesy of D.C.C. Duly, Director, Habinteg Housing Association (Ulster) Ltd, Northern Ireland

127, 128. Courtesy of Leif Jahlenius, Stockholms Fastighetskontor, Stockholm, Sweden

129, 130, 131. CMHC. Courtesy of Don Ament and Wayne Benedet, Winnipeg

132, 133, 134, 135, 136, 137. CMHC. Architect Richard A. Reichard, Snider Reichard March Architects, Waterloo, Ontario

138, 139, 140, 141, 142, 144. CMHC

143. Courtesy of architect Pierre Richard, Montreal

145, 146, 147. Courtesy of architect John B. Davidson, Davidson/Yuen Partners, Vancouver

148, 149. Courtesy of architect Jens Bjorneboe, Norwegian Research Institute, Oslo

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